Exploring women community college natural scientists' personal experience narratives through a subjectivist lens

by

Nancy Anne Woods

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Program of Study Committee:
Larry Ebbers, Co-Major Professor
Robyn Cooper, Co-Major Professor
Frankie Santos Laanan
Latrice Eggleston
Dan Robinson

Iowa State University

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DEDICATION

This dissertation is dedicated to my wonderful husband and partner in life,

David A. Woods,

who consistently believed in and encouraged me through this entire process.

And to my parents

Rev. Robert E. Shirck

and Norma C. Shirck

who raised me to believe that life-long learning was important and for

encouraging me to not listen to the Sirens.

And to my children

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Ward D. Woods

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Nicholas A. Woods

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whom I love the most.

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"For I know the plans I have for you, declares the Lord, "plans to prosper you and not to harm you, plans to give you hope and a future. Then you will call upon me and come and pray to me, and I will listen to you. You will seek me and find me when you seek me with all your heart. I will be found by you," declares the Lord, "and will bring you back from captivity." Jeremiah 29: 11-14 [NIV]

I start my acknowledgements with this particular scripture because it was this scripture that spoke strongly to me during the down times of this research process. I happened to find this scripture at a time when I was deeply questioning why I had selected this project, this method, and this topic to research. This scripture spoke to my heart and reassured me that God was in control and that He had a plan for my life. Further this scripture spoke to my heart that completing this dissertation really was part of His plan. All glory to God the Father, the Son, and the Holy Spirit.

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ABSTRACT

The thrust in education today is to encourage young women to enter nontraditional fields of study such as chemistry, physics, and biology. In order to better prepare the next generation of women scientists, then, we should examine the experiences of women participants already working within these areas. We can learn from their experiences. What motivated them toward science? What influenced them to become teachers? What brought them to the community college? If the premise is that we want more women involved in science, then one way to understand *how* to entice women into science would be to research those who are already there. This research project has two important findings, (1) women community college natural science instructors can experience issues of identity between their roles as scientists and teachers; (2) women community college natural science instructors value a different community structure compared to many of their male counterparts. This research lists several recommendations for future practice as well as recommendations for future research.

Chapter 1

INTRODUCTION

"Let [Truth] and Falsehood grapple; who ever knew Truth put to the worse, in a free and open encounter." [Milton, "Areopagitica," 1644]

Today's thrust in higher education is to encourage more women to enter nontraditional fields of study such as chemistry, physics, and biology. Therefore, in order to better prepare the next generation of women scientists we should examine the experiences of women participants already working within these areas. We can learn from their experiences. What motivated them toward science? What influenced them to become teachers? What brought them to the community college? If the premise is that we want more women involved in science, then one way to understand *how* to entice women into science would be to look at those who are already there.

Women in science face many complicated and layered issues. Although women are encouraged to enter challenging fields of study, once there they often find a chilly, complicated, and unwelcoming climate. Women continue to struggle with messages encouraging them to simultaneously focus their energies toward their families and toward their professional careers. Scientific reasoning skill often obscures a woman's sensitivity as a decision maker within the family. Yet "mothering" is not deemed to be scientific. Within the professional realm does the woman portray herself as a stalwart unemotional combination of intellect and higher order reasoning to then return to her family as a patient calm nurturing caregiver? This splintered nature haunts women as they strive to prove themselves within their scientific professional careers and simultaneously navigate within their families. The "do it all" attitude weighs heavily on women as they seek

order and balance. There is a continuous struggle between the conflicting identities of being a woman, and simultaneously, a scientist.

> Women who manage to get jobs in science have to handle a peculiar contradiction between being women and not women (i.e., scientists) at the same moment. Many have resolved this by withdrawing or letting themselves be excluded from science; others become essentially honorary men, denying that being a woman creates any problems at all. Long before the postmodernist language of multiple fractured identities enriched feminist analysis, it was understood that a women scientist is 'cut in two.' Ruth Wallsgrove wrote, "A woman, especially if she has any ambition or education, receives two kinds of messages: the kind that tells her what it is to be a successful person; and the kind that tells her what it is to be a 'real' woman." (Rose, 1994, p. 14)

As Rose points out, women in science find themselves split between their positions as women and as scientists. Further, community college women science faculty find themselves even more splintered because their university counterparts often view them as simply advanced-high-school educators who have forfeited a real scientific identity. Women who choose to teach their science rather than research their science are commonly viewed as being less of a scientist. Paradoxically it seems that scientists can be teachers but teachers cannot be scientists. But how do these women resolve this divergence? How has postmodernism and feminism assisted us to understand and interpret these women? It is imperative that we examine this rift in order that we can better guide and lead women into fields of science in the future.

Problem

Women's professional work roles historically include teaching, secretarial, and nursing positions. One might argue that women community college natural sciences instructors have somehow managed to roll all three of these traditional roles into one big profession. As a community college instructor, the teaching role is one's primary job responsibility—but coincidentally it turns out that this role frequently incorporates the tasks of secretary and nurse into that job description as well. To this end, this investigation into the lives of women who find themselves as full time teaching science faculty at the community college will lead us to a better understanding of the depth and breadth that these women have penetrated the profession of science.

The problem to be investigated in this research asks how women community college instructors of the natural sciences came to the place that they find themselves. I am exclusively interested in studying the place that women faculty of biology, chemistry and physics who teach at the community college find themselves at and how they got there. As these women are often the front-line guides for the next generation of women in science it is therefore very important that we examine things that influenced, persuaded, and affected the decisions that brought these women to become community college natural science faculty.

Purpose

The purpose of this research is to look into the lives of women natural science instructors at the community college to better understand how they make meaning of

their multiple identities as well as the events, influences, and forces that brought them to their faculty roles at the community college.

Research Questions

The research questions that will be examined are centered on women who teach in the natural sciences (biology, chemistry, and physics) at community colleges. The investigation asks how women in the natural sciences describe their journeys which brought them to their respective community colleges. As such, the research questions below served to guide this study:

1. How do women community college natural science faculty make meaning of their current academic and social experiences within their science based upon their postsecondary educational experiences?
2. What role does a woman's community and personal support systems have on the decision making process for these women community college natural science faculty as they chose careers within STEM fields?

Rationale

My attraction to the study of women community college natural science faculty stemmed from both my professional and personal experiences. Early in my educational career I was identified as a "smart" student and steered toward studies in mathematics and science. I found mathematics to be logical and rational; physics was orderly, predictable and calculatable. In the 1970's, as an undergraduate, there were very few women in these fields with me at the university. Today I see about the same number of women in my own classrooms as there were back when I was an undergraduate. As I look around (then and now) I have always wondered where all the women were.

I believe the defining moment for the development of this research came one night, early in my doctoral studies, when one of my professors blatantly and flatly asked me if I understood how, through no choice of my own, I was forced to become an educator. I felt so insulted by this instructor! How could she imply that I had not made my own decisions? How could she be so blind to my intelligence? It took quite a while for me to understand how she was able to ask such things. Ultimately her inquiry stuck with me throughout my doctoral studies; it was the source of questioning that I wrestled with throughout my work. These questions brought me to the place of asking how *other* women understood the paths that brought them to become science faculty at the community college.

Over the years I have repeatedly seen women silence themselves when they believed they were alone and shamed within their experiences. For example, when I chose to loose weight and attended a Weight Watchers group I found that this group affiliation opened up the doors to conversations with women that I would otherwise never shared because of mutual insecurities and embarrassment. Later when I had a miscarriage I found that almost every woman I knew had gone through that same experience but had yet to share their knowledge, feelings and insights with any one else because of a sense of shame and deficiency. Incidents such as these have caused me to question what other commonalities women share but don't openly discuss. I have first-hand seen the benefits that can be reaped when women self reflect upon their personal experiences and come to understand the truths and knowledge they share. It was simply natural for me to investigate the sciences that I am so familiar with as well as other women faculty that are like me.

Significance of Study

I am convinced that studying the lives of women natural science community college instructors will shed light on the study of curriculum and schooling of next generations of women within STEM fields. If we can learn from their experiences through their own voices then this will give insight into future possible implications for both teachers' lives and the curriculum they teach. Also if we come to understand and interpret the experiences of women natural science educators we might be able to shed light upon science in general and ways in which to actively engage, recruit, and retain females into STEM fields and careers.

While there are studies that look at women in science, women as faculty, and the community college as a site of learning; no study exists that combines these three complex identities. The information from this study provides a more accurate and in-depth understanding of how women in the natural sciences view the paths that brought them to the community college that they teach. This study considers the impact of nonunitary subjectivities on the professional and personal lives of women natural science faculty.

Theoretical Perspective

In the theoretical basis for this research, it is important to develop a "ground up" understanding for the call of this research. To begin with, I summarized postmodern feminism as the theoretical platform that I embrace. There I introduce the distinction between the traditional archetype and the postmodern feminist paradigm understandings of truth and knowledge. I introduce how, like truth and knowledge, postmodern feminist

identities are multiplistic and layered. Next I indicate the theoretical relevance postmodern feminism has on education in general. Lastly, I situate postmodern feminism within the theoretical dais of science. This last development is challenging, since traditionally, science is viewed as rational, universal, and elite. To come to an understanding that science is *not* the separate, precise, and controlled theory it once was thought to be is revolutionary.

Postmodern Feminism

Feminism and postmodernism seek to challenge traditional definitions of truth and knowledge. Specifically, "postmodernists seek…to develop conceptions of social criticism which do not rely on traditional philosophical underpinnings" (Fraser & Nicholson, 1990, p. 21). Postmodernism is, according to Gergen (1991), "marked by a plurality of voices vying for the right to reality—to be accepted as legitimate expressions of the true and the good" (p. 7). Richardson (1994) claims that,

> The core of postmodernism is the *doubt* that any method or theory, discourse or genre, tradition or novelty, has a universal and general claim as the "right" or the privileged form of authoritative knowledge. Postmodernism *suspects* all truth claims of masking and serving particular interests in local, cultural, and political struggles. (p. 517)

Postmodernism is not above reproach. Rather, its intent is to incorporate new methods and techniques of inquiry (together with traditional ones) into the limelight of critique.

On the other hand, feminism embraces the postmodern position but has furthered the horizon of common theoretical philosophy. According to Fraser & Nicholson (1990),

> [Feminists] have criticized modern foundationalist epistemologies and moral and political theories, exposing the contingent, partial, and historically situated character of what has passed in the mainstream for necessary, universal, and ahistorical truths. They have called into question the dominant philosophical project of seeking objectivity in the guise of a "God's eye view" which transcends any situation or perspective. (p. 26)

In general, the goal of feminism is to understand, improve, and include women and men within the production of knowledge and truth. It is an inclusive theory and practice which seeks to socially, culturally, economically, relationally, and historically represent those groups which have been dominated and marginalized (Martusewicz & Reynolds, 1994).

To combine postmodernism and feminism is to challenge the inviolability of Universal Truth and Knowledge. Postmodern feminist theory is nonuniversalist. Its mode is comparative rather than omniscient; its focus is on differences and dissimilarities rather than sheathing edicts and conformity. Postmodern feminist theory endeavors to supplant unitary notions of gender identity with plural, complexly constructed, social identities treating gender as one relevant strand among others (Fraser & Nicholson, 1990). It recognizes that women's needs, experiences, and subjectivities, are diversified and without an all-encompassing universal description.

> Thus, the underlying premise of this practice is that, while some women share some common interests and face some common enemies, such commonalities are by no means universal; rather, they are interlaced with differences, even with conflicts. This, then, is a practice made up of a patchwork of overlapping

> alliances, not one circumscribable by an essential definition. (Fraser & Nicholson, 1990, p. 35)

In essence, postmodern feminist theory "would look more like a tapestry composed of threads of many different hues than one woven in a single color" (Fraser & Nicholson, 1990, p. 35). Postmodern feminist research, then, seeks to weave a colorful path. Further, it challenges traditional relationships, even those between the researcher and those being researched (Bloom, 1998).

The context of postmodernism and feminism asserts that claims of knowledge and truth do not exist as isolated entities. They are not detached, unbiased, neutral, and seamless axioms describing the human condition. Rather, knowledge and truth are rooted in specific positions and assumptions; therefore, knowledge and truth are relational. "Normativity is displaced by multiplicity—a theoretical notion depicting social and cultural phenomena more in terms of complexity and difference than simplicity and similarity" (Rhoads & Valadez, 1996, p. 21).

Postmodern feminism helps us to understand that knowledge and truth are situated within the context of power and domination (Goldberger [et al.], 1996, McNeil, 1993; Nicholson, 1990; Lyotard, 1984; Tierney & Rhoads, 1993). In this theory, we are liberated beyond constructs of power and the dominant discourse to reveal absent erudition. Alternative sites of knowledge are exposed.

> [O]ur interviews with women uncovered salient themes…related to the experience of silencing and disempowerment, lack of voice, the importance of personal experience in knowing, connected strategies in knowing, and resistance to disimpassioned knowing. Such themes suggested to us that there are hidden

> agendas of power in the way societies define and validate and ultimately genderize knowledge; the stories women told depicted a variety of different ways women understand, accommodate, and resist societal definitions of authority and truth. (Goldberger, 1996, p. 7)

Postmodern feminism seeks to destroy the impediments that have silenced marginalized groups (e.g., women); its goal is to liberate subverted knowledge and truth from oppression by the traditional patriarchal realm.

Through postmodernism and feminism we come to understand, like knowledge and truth, identities are framed through multiple discourses. The notion that identities are invariant, objective, and fixed is replaced by a more emancipating, relational, and socially situated description. Through this theoretical stance, we understand notions of identity by "peeling away" at the layers of discourses which influence their emergence. Some of the discourses (among others) that frame our social identities include power and power relations, struggle and resistance, reaction to patriarchal hegemonies, as well as cultural oppression and exclusion.

Power and power relations are central issues that dominate the discourse of social identity. Through postmodern feminism, power structures are disrupted in order that marginalized groups have voice.

> Our agenda, whether we are engaged in adding to the descriptive material on women's experience or in building theory, is to expose the unequal distribution of power that has subordinated women in most if not all cultures and discover ways of dismantling hierarchies of domination. (Wolf, 1992, p. 119)

Only through struggle against dominant power structures can those who are oppressed more fully inform their identities as situated, positioned, and subjugated.

> This is what the study of gender, class, and race is really about: how subordinated sectors accommodate to and resist the power of privileged sectors, how privilege (like resistance) is camouflaged, how power is earned, learned, and occasionally spurned. Just as the reality of male privilege affects the lives of every woman, whether she is conscious of it or not, the concept of power is by definition a factor in every feminist's research. (Wolf, 1992, p. 133)

Through an understanding of power and power relationships, the language and understandings of social identity can be more fully developed. Developing an awareness of power (and its relations) is a necessary start to revealing its effects and consequences throughout our layered identities.

Also included in the discourse of identity is the notion of resistance. Kincheloe and McLaren (1994) summarize postmodern resistance theorists' stance:

> Resistance postmodernism does not abandon the undecidability or contingency of the social altogether; rather, the undecidability of history is understood as related to class struggle, the institutionalization of asymmetrical relations of power and privilege, and the way historical accounts are contested by different groups (Giroux, 1992; McLaren & Hammer, 1989; Zavarzadeh & Morton, 1991). (p. 144)

The understanding of the consequence of struggle and resistance through the lens of postmodern feminism "can serve as an interventionist and transformative critique of Western culture" (Kincheloe & McLaren, 1994, p. 144). Hence the discourse of identity

can be written to embrace the social and historical conflicts that have molded its emergence.

A direct consequence of subverting the dominant discourse by revealing notions of power and resistance is a realization of the effects that patriarchal hegemony has had on identity.

> Patriarchy is the structure and system where the value of women is obscured or diminished, and where women are devalued through gender-based inequalities in areas such as employment, education, and social activities. The inequities may be subtle…or blatant…but they all represent socially sanctioned methods of keeping women in a lesser position than men. (Bing & Reid, 1996, pp. 187-188)

The great impact that postmodern feminism has had on issues of patriarchal hegemony is in its liberty to validate and signify individualism and uniqueness rather than domination and universalism. This multiplicity subverts singularity within identity.

> [O]ne of the key locations where social and semiotic struggles are entered, where the weak engage with the strong, is this interface between practice and structure. This is also where social differences of identity and social relations can be struggled over, where the top-down or bottom-up control over such difference can be contested. It is a crucial site of the hegemonic process, and it can be analyzed only by a theory that grants particularities a greater significance…. (Fiske, 1994, p. 198)

"Routine" actions, "unconscious" knowledge, and "cultural" memories are positions calling for awareness within postmodern feminist hegemonic influence. The effects of

the disjuncture between identity discourses are revealed at these locations (Kincheloe & McLaren, 1994).

Further, postmodern feminism frames the discourse of identity through the notion of culture. Culture is commonly referred to as the expression of one's ethos, principles, mores, and values as understood by groups (large and small) of people. But from where was our notion of culture developed? Whose culture defined our identities? According to Stanfield (1994):

> What makes hegemony such a powerful source of social and political control is that the imposition and diffusion of the ethnic cultural particulars of the dominant create and institutionalize impressions in public culture and life that there is a societal consensus that the culture of the dominant is universalistic rather than particularistic. (p. 177)

It is within this definition of universalized culture that we become aware of the philosophy of Other and Self. To deconstruct such notions, however, is to "braid political and contextual struggle back into our texts" (Fine, 1994, p. 71). The dissonance between codes of culture and discourses of identity is a crucial juncture for critical examination. Postmodern feminism presents a model for exploring the relationship between self identity and cultural representation. Fine (1994) quotes Hall (1991):

> History changes your conception of yourself. Thus, another critical thing about identity is that it is partly the relationship between you and the Other. Only when there is an Other can you know who you are. To discover the fact is to discover and unlock the whole enormous history of nationalism and of racism. Racism is a structure of discourse and representation that tried to expel the Other

> symbolically—blot it out, put it over there in the Third World, at the margin. (p. 72)

Notions of Other, then, are defined in terms of separatist (elitist) cultures that, through hegemonic forces, externally dictate privilege of the few over the many. The traditional discourse of identity is camouflaged by concepts of Other.

On the other hand, the notion of the cultural Self is more internally defined within the discourse of identity. To define Self (with a capital *S*) is to use expressions such as unitary, autonomous, conscious, objective, rational, separate, essential, and singular. Postmodern feminism allows us to understand self (with the lower case *s*) as nonunitary, relational, interconnected, multiple, subjective, dependent, and interwoven. This is the plural nature within the discourse of postmodern feminist cultural identity.

We cannot confuse one's manifold layered identities as a puerile development of self. To embrace multiplicity and miscellany is a resistance of Othering. Within postmodern feminism individuals are understood as "honest narrator[s] of multiple poststructural selves speaking among themselves, in front of an audience searching relentlessly for pigeonholes" (Fine, 1994, p. 71). To resist notions of "pigeonholing" is to allow for a simultaneous multiple self. This approach guards against universalistic notions of a unified Self.

Postmodern Feminism in Education

Because educational institutions play a central role in defining the "true and the good," it is easy to see why the struggle for identity (and plural subjectivities) is so closely linked to educational processes. Postmodern feminism calls attention to the fact that,

> [E]ducational institutions must come to terms with how identities are legitimized or denigrated and the role schooling plays in identity development. For too many years, educators have failed to understand or have ignored the fact that knowledge is culturally derived and therefore has significant implications for which groups achieve academic and economic rewards and which groups are denied." (Rhoads & Valadez, 1996, p. 215)

Postmodern feminism calls forth many ideals within the realms of education. Through its practice, inclusiveness is encouraged at all educational levels. Those groups that have historically been marginalized are called to the center of the text within the postmodern feminist educational manuscript.

Left unattended, the dominant discourse within education will maintain its status quo. Education's power structures will continue to practice selective historical remembrances and subvert repositionings from marginalized groups.

> Critical theorists are generally concerned with issues of social justice and believe that many of the institutions and structures that organize our lives, especially our economic system, the state and its institutions, operate to keep in place fundamentally unequal and unjust social and political relations. (Martusewicz & Reynolds, 1994, p. 6)

To this end, critical education theorists are vigilant to challenge "normalcy" and probe regimes of power. In turn, disruption is imperative.

Accordingly, within educational structures, power and power relations need to be exposed at all educational levels. Gore (1994) summarizes Foucault's position:

> [I]n education, it is clear that power is not solely in the hands of teachers. Students, as well as teachers (and parents and administrators and governments), exercise power in schools. In order to understand the operation of power in any context, we need to understand the particular points through which it passes. (p. 112)

Schooling and education must revisit and closely examine the roles that power plays within its structures. Within these relations, power has a ubiquitous nature.

> Power operates in all our discursive practices; our words, our practices, our theories will have specific effects on the lives of others. No theory or method or form of pedagogy can ever be innocent; no approach to teaching is inherently liberating or free of the effects of power. (Martusewicz & Reynolds, 1994, p. 13)

Power and power relations, therefore, must be included within the discourse of postmodern feminist education.

The notion that "knowledge is power" is one that motivates many within the world of education. But educational spheres are being called to examine several pervasive questions. *Whose* knowledge is *what* kind of power? Who benefits from the knowledge being taught? What hidden connotations are associated with the likening of knowledge to power? How does this reinforce the reproduction of marginalization and exclusion? Ellsworth (1994), discussing representation within the classroom, states, "all knowledge is socially constructed and linked to power and its interests" (p. 101). She continues:

> For someone in a social or cultural group that has been made invisible, marginalized, and misrepresented through efforts to perpetuate its subordination

> and exploitation, the question of *whose* knowledge should be taught is necessary, but not sufficient. Groups whose social or cultural identities and knowledges are not articulated in the terms needed to provoke curriculum change in schools and universities, or whose forms or identities and knowledges are not effective within and responsive to changed and changing circumstances, must engage, at some point, with the politics of representation. (Ellsworth, 1994, p. 104)

Postmodern feminism calls education to resist notions of singularity and uniformity, and to challenge hegemonies that subjugate underrepresented and marginalized groups.

The educational environment provides a primary platform for postmodern feminism to be vigilant toward the relation between knowledge and power. Giroux (1996) urges educators to afford an environment where "fugitive knowledge" is exchanged and produced. He beckons educators:

> As public intellectuals, university teachers need to provide the opportunities for students to learn that the relationship between knowledge and power can be emancipatory, that their histories and experiences matter, and that what they say and do can count as part of a wider struggle to unlearn dominating privileges, productively reconstruct their relations with other, and transform, when necessary, the world around them. (p. 128)

Theoretical and practical recognition of the relationship between knowledge and power helps us to mold our understandings of culture and identity within the educational setting.

Giroux draws our attention to the social and political implications of the educational culture that is promoted within our schools. Expressing his sense that this is a dangerous time for our country's youth, he implores educators to critically examine and

address cultural hegemonies. He connects "knowledge and power to a profound impatience with the status quo, and human agency to diverse and multiple ethics of social responsibility" (Giroux, 1996, p. 125). He advocates politicizing education to decenter power structures and liberate individuals, identities, and cultures. In this capacity, educators will equip their students to be critical agents with their own vision of developing, widening, and evolving the possibilities for a democratic public (Giroux, 1996).

The developments of techniques by which educators can reveal the dominant discourse within cultural identity is an essential, albeit challenging, task. Students that enjoy privilege resist those who claim "knowing." They attempt to disempower subordinate groups who threaten to expose privileged knowledge.

> As a feature of classroom dynamics, the unpacking and uncovering of deeply submerged social practices of domination/entitlement experienced by the "Other" as subordination/oppression, can itself become another source for experiences of oppression. Alternately such experiences of oppression can foster a powerful desire for change, or they can become a deeply destructive experience ultimately resulting in reactionary responses from men *as well as* from women. (Lewis, 1993, p.165-166)

Thus it is imperative that educators incorporate postmodern feminist curricula to transfer legitimacy and authority to groups which are underrepresented and marginalized.

> Most important to what multiculturalists seek to accomplish is the fact that just as culture gets ranked as superior or subordinate, social identities become categorized in a similar manner. To reject the canon and instead provide a

> diversity of learning experiences designed to engage students and teachers in a critique of knowledge and cultural production is to take issue with the hierarchical nature of social identities. The goal is not only to understand cultural identities different from our own, but to move beyond classifications that seek to marginalize and disempower. (Rhoads & Valadez, 1996, p. 23)

The call of the postmodern feminist classroom is one of liberation. Such classrooms provide learners (at all levels) with a variety of experiences that allows them to explore, understand, validate, and become engaged with, the eclectic diversity of the participants' cultural identities and subjectivities.

Within all educational disciplines and throughout all stratums of education, postmodern feminism calls participants to examine the maelstrom effect hegemonic forces have had.

> In the century to come, educators will not be able to ignore the hard questions that schools will have to face regarding issues of multiculturalism, race, identity, power, knowledge, ethics, and work. These issues will play a major role in defining the meaning and purpose of schooling, the relationship between teachers and students, and the critical content of their exchange in terms of how to live in a world that will be vastly more globalized, high-tech, and racially diverse than at any other time in history. (Giroux, 1996, pp. 17-18)

No discipline or area within education is immune from this examination. Vast possibilities exist for the promotion of representation, voice, and diversity within postmodern feminist classrooms.

Postmodern Feminism in Science

What implications does postmodern feminism offer to science? Historically, natural science has been thought to be the most pure, elite, and untouched by human interjection than any of the other sciences (e.g., social science). The hegemonic culture within natural science perpetuates the reproduced myth of the impartial experiment, with scientists as knowledge producers and disseminators of truth. Since science is socially situated, it cannot be neutral.

> The decision to retreat from scenes of domination in the name of science is oxymoronic witnessing injustice without outrage. The Other is constituted. The Self is shadowed. Science is preserved. Prevailing politics prospers. Objectivity is assumed. (Fine, 1994, p. 76)

Through the lens of postmodern feminism we come to understand the fallacy of such thinking. Scientific truth and knowledge are "permeated by the social relations through which they come into existence, but it is contemporary social relations that create and recreate science and knowledge today" (Harding, 1996, p. *ix*). Lyotard (1984) calls all truisms fallacious. He argues that the natural sciences offers only one interpretation of knowledge: "It has always existed in addition to, and in competition and conflict with, another kind of knowledge, which I will call narrative" (p. 7). Postmodern feminism is a naissance for an agenda that engenders a newly liberated natural science.

> Women need sciences and technologies that are *for* women and that are for women in *every class, race, and culture*. Feminists…want to close the gender gap in scientific and technological literacy, to invent modes of thought and learn the existing techniques and skills that will enable women to get more control over

> the conditions of their lives. Such sciences can and must benefit men, too—especially those marginalized by racism, imperialism, and class exploitation; the new sciences are not to be *only* for women. (Harding, 1996, p. 5)

Natural science needs to embrace the miscellany of voices it represents. Keller (1996) challenges the theoretical universality of scientific rationalism. Her vision is not to create a different (nor feminine) science, rather, a liberating one.

> The task this implies for a radical feminist critique of science is, then, first a historical one, but finally a transformative one. In the historical effort, feminists can bring a whole new range of sensitivities, leading to an equally new consciousness of the potentialities lying latent in the scientific project. (Keller, 1996, p. 39)

This new science would be "less restrained by the impulse to dominate" (Keller, 1996, p. 39). Postmodern feminism allows us to understand that science has (all along) been distorted and unbalanced representations of power and ascendancy. To this end, a destabilized and decentralized science must emerge.

Some outcomes of postmodern feminist theory are that scientific research can further develop its applicability and usefulness. In this progressive and empowering stance, scientific research will achieve new ends. As a consequence, postmodern feminist theory applied to natural science research inspires a new democratization of science.

> As John Dewey maintained decades ago, science narrowly conceived as a technique puts the power of inquiry in the hands of those at the top of the hierarchy who, by way of their education or status, are pronounced most

> qualified. These elites engage in research, turning over the data (the product), not the methods (the process), of their inquiries to low-status practitioners who follow their directions. When workers take part in research and legitimate their own knowledge, then scientific research will be better able to serve progressive democratic goals. (Kincheloe & McLaren, 1994, p. 150)

Rather than adhering to statements, theories, and structures, which accentuate an illusive objectivity, postmodern feminist natural science embraces unfeigned subjectivity at all echelons.

Through postmodern feminism the production of knowledge is grounded in humanistic expressions of feeling and emotion. "So far from feeling being seen as mere subjectivity, something to be overcome in the search for objectivity, they are seen to be a source of knowledge" (Griffiths, 1988, p. 135). Griffiths (1988) discusses how, within science, truth and knowledge are distorted without the acknowledgment of feelings:

> Most seriously, one way in which distortion has occurred is in the conceptualization of truth and knowledge themselves. Evelyn Fox Keller…has discussed this process of science. She argues…that the kinds of rational objectivity and technical control taken to be constitutive of science are distortions introduced by unacknowledged and unexamined myths of masculinity which have their roots in typically masculine ways of feeling and which pervade scientific thought. (p. 135)

Postmodern feminism alerts us toward liberated scientific awareness, rather than perpetuating science as untouched, separate, and disembodied. Historically, the natural sciences have asserted an abstract ability to sever the subject from the object—what is

seen and what is being seen. Postmodern feminism, however, views science through a different scope: it maintains that scientific vision is nonuniform, changing, and disheveled. It embraces the verity that what one "sees" is not what all "see" (Keller & Grontkowski, 1996).

Through an understanding of postmodernism and feminism, we can come to understand scientific truth and knowledge through different contexts and at nontraditional sites. Here, uniformity and conformity are replaced by multiplicity and diversity. Understandings of scientific knowledge, as it is connected to power, domination, and hegemony, are central to issues of identity within institutions of higher learning.

Postmodern feminism is exciting in its applicability to the two professional areas in which I am most involved: education and science. What I understand about this theory has greatly affected my views about my professions. As an instructor, I am greatly concerned about how I should teach, what I should teach, who is missing from my classroom, and how I am positioned within the classroom. As an instructor collaborating with other instructors I have a heightened awareness of who is teaching at the community college level, how instruction is being accomplished by those present, and what structures are being reinforced—rather than challenged—within higher education. As a woman member of the community college science faculty I question how we became educators, what influenced (or failed to influence) our development, and why we are where we are. It is through this lens that I have come to research those whom I am closest to.

Within this research project I have chosen to explore, using feminist methodology and interpretive methods, women community college natural scientists' personal experience narratives. While this research critically investigates science through

postmodern feminist interpretive methods, it is also a reflection of my own understandings of identity, subjectivity, and theoretical practices. The process of writing this dissertation has allowed me to investigate my own positions and relations within postmodern feminism; I have been afforded an opportunity to critically question claims of knowledge and truth.

Nonunitary Subjectivity

Traditional views about women's lives include the position that understandings of identity and experience should be made through a completely objective authorized subject position. The implication is that Self is unitary.

> The authorized subject thus achieves and maintains his authority by his ability to keep his body and the rest of the world radically separated from his ego, marked off from it by policed boundaries. Within those boundaries, the self is supposed to be unitary and seamless, characterized by the doxastic virtue of noncontradiction and the moral virtue of integrity. The social mechanisms of privilege aid in the achievement of those virtues by facilitating splitting and projection: the unity of the privileged self is maintained by the dumping out of the self—on to the object world or on to the different, the stigmatized Others—everything that would disturb its pristine wholeness. (Scheman, 1996, p. 211)

Dumping of annoying incongruencies to Other perpetuates the Universalized Self. The implications of maintaining Self and Other are disempowering to groups existing at the peripheral. Such groups have endured contradictory experiences of fragmentation and ambiguousness.

> Because of women's long history of material marginalization, patriarchal oppression, colonization, physical abuse, and the psychological damage of being demeaned by the pervasive hierarchical structuring of the sexual differences of male/female, women have internalized many negative and conflicted ideas of what it means to be a woman. Both negative feelings and experiences and diverse conflicting interactions and experiences—affirming or negating—result in subjectivity's fragmentation. (Bloom, 1998, p. 5)

Women's marginalization has been derived from multiple sources and hidden agendas. One such source is Science. Science, as an idealized institution, has played a large part in the prolonged establishment of Universalism. Its rigor has impacted aspiration toward the imagined necessity of an essential unified self. Adhering to the theorem that Science is Truth has only accentuated the concept of a fused Self. This closed fixation presents confusion when "cacophonous visions and visionary voices that characterize the knowledges of the subjugated" (Haraway, 1996, p. 258) are exposed. Ironically, serendipitous occurrences within science have long conflicted with the theory of science as universalized understanding. To this end, understanding Science as a myth is concurrent to the superseding of Universalized Self and Other.

Postmodern feminism deconstructs the notion of universalized homogeneity within human agency. "[S]ubjectivity is…thought to be nonunitary or active and continually in the process of production within historical, social, and cultural boundaries" (Bloom, 1998, p. 4). The *Self* (as understood to be whole and unified) is dismantled. The *self* (as understood to be fractional and disjoint) is constructed. The theory of nonunitary

subjectivity "resists essentializing individuals by naming a particular immobile identity" (Bloom, 1998, p. 6).

> The new mestiza copes by developing a tolerance for ambiguity….She has a plural personality, she operates in a pluralistic mode—nothing is thrust out, the good, the bad and the ugly, nothing rejected, nothing abandoned. (Scheman, 1996, p. 211)

To advocate this epistemology evinces an "unconditioned position, the position of no position that provides a view from nowhere" (Longino, 1996, p. 270). This fragmentation, mixing, splintering, and indefinition of our nonunified subjectivities "is a move toward a more positive acceptance of the complexities of human identity, especially female identity" (Bloom, 1998, p. 6).

An understanding of the plural and webbed nature of self, therefore, is an articulation toward an alternative conception of a nonunitary subject. The dismantling of Self has connotations for both those being researched as well as the postmodern feminist researcher. Concomitant to this evolution, science must be reinterpreted.

> Feminism loves another science: the sciences and politics of interpretation, translation, stuttering, and the partly understood. Feminism is about the sciences of the multiple subject with (at least) double vision. Feminism is about a critical vision consequent upon a critical positioning in unhomogeneous gendered social space. Translation is always interpretive, critical, and partial. Here is a ground for conversation, rationality, and objectivity—which is power-sensitive, not pluralist, 'conversation.' (Haraway, 1996, p. 258)

This is a starting point for transformation within processes involving postmodern feminist research relationships.

> As a process, fragmentation, and discursive and lived practice, nonunitary subjectivity must be considered a meaningful category of feminist analysis, for it encourages women to understand how we can be open to new ways to understand the world, to think about experiences, or to reflect on one's self. (Bloom, 1998, p. 6)

The interpretation of truth and knowledge will be fueled through new veins and at sites of human reaction.

For those being researched, this perspective gives rise to a new freedom within one's own subjectivities. Rather than adhering to an imaginary, immobile, and inaccessible Universal Self, respondents can come to unabashedly understand and embrace their identities as splintered, mutable, multi-layered, and evolving. For those conducting research, this perspective allows for greater researcher participation. The researcher no longer maintains impartiality, rather, she recounts for her personal biases and perspectives. The archaic "invisible hand" of the researcher is put asunder. Clear respondent and researcher voice, imperfection, and subjectivities, are signifiers of such research.

In this research project, nonunitary subjectivity is a postmodern feminist theoretical framework through which I have examined the narratives of my respondents. The process of revealing nonunitary subjectivities within each of these community college natural scientists' personal narratives is a unique approach to development of scientific understanding (as compared to traditional "scientific methods"). To understand

Liza through persistent periods of self-proclaimed dependency and independency helps us to grapple with her issues of power and power relations. To disclose the discordance between Holly's evolving definitions of "teacher" helps us to reflect upon her issues of resistance and struggle. Lastly, Anna's layered designation as "student" is best viewed through her experiences involving patriarchal hegemony. Additionally, to reveal nonunitary subjectivities collectively within these community college natural science instructors' experiences calls us toward redefinition and further development within science.

Embracing nonunitary subjectivity leads us to the development of new avenues for writing and revealing truths of a woman's life. Postmodern feminism calls us to dispel the obsession with "fairy tale endings" in our writings about women. The fascination with happy endings only serves to promote Universalization and Othering.

> Romance as a mode may be historically activated: when middle-class women lose economic power in the transition from precapitalist economies and are dispossessed of certain functions, the romance script may be a compensatory social and narrative practice. (DuPlessis, 1985, p. 2)

In this promotion of power, which further marginalizes women, the authentic narrative is usurped. The traditional genre of women's autobiography "tends to find beauty even in pain and to transform rage into spiritual acceptance" (Heilbrun, 1988, p. 12). Accounts such as these have a propensity to conceal anger, illustrate struggle as dispassionate, and camouflage pain. In turn, women's accounts continue to be fictionalized and romanticized.

As we search for nonunitary subjectivities, our research and writing must not ignore pain and rage. "[W]hat has been forbidden to women is anger, together with the open admission of the desire for power and control over one's life…." (Heilbrun, 1988, p. 13). Our questions should be of women's time, women's place, and women's location in society. These inquiries are likely to expose "a mask of unrecognized anger" (Heilbrun, 1988, p. 15). Recognizing women's anger is an avenue for reclaiming power and control.

Through postmodern feminist understandings, we develop nonunitary subjectivities as possible interpretations of women's narratives. Traditionally, women were written as having *a* story, a singular possibility, a unified ending.

> [L]iterature as a human institution is, baldly, organized by many ideological scripts. Any literary convention—plots, narrative sequences, characters in bit parts—as an instrument that claims to depict experience, also interprets it. No convention is neutral, purely mimetic, or purely aesthetic. (DuPlessis, 1985, p. 3)

The romantic endings where the beautiful woman is married and lives in a house with a white picket fence "are the only stories for women that end with a sense of peace, all passion spent, that we find in the lives of men" (Heilbrun, 1988, p. 39).

> I have read many moving lives of women, but they are painful, the price is high, the anxiety is intense, because there is no script to follow, no story portraying how one is to act, let alone any alternative stories. (Heilbrun, 1988, p. 39)

Nonunitary subjectivities are the alternative stories we can give to women.

Definitions

This section provides definitions for terms that were used throughout this study.

Hegemony – "The predominant influence, as of a state, region, or group, over another or others" (http://dictionary.reference.com/browse/hegemony).

Marginalize – "To relegate or confine to a lower or outer limit or edge, as of social standing; to place in a position of marginal importance, influence, or power" (http://dictionary.reference.com/browse/marginalize). This term refers to the viewing of a particular individual or group as being outside and beyond the main text of the story.

Natural Sciences – 'Natural science' is an umbrella term covering all the disciplines which seek to explain natural phenomena. These disciplines include biology, chemistry and physics.

Nonunitary Subjectivity – Feminist postmodern theory maintains that subjectivity is always active and in the process of production, or nonunitary. It is "an ongoing process of engagement in social and discursive practices…a continuous process of production and transformation [and]…a 'doing' rather than a being" (Robinson, 1991, p. 11). Subjectivity—particularly women's subjectivity—is also thought to be continually fragmenting from daily experiences living with the pervasive hierarchical, patriarchal structuring of sexual difference through which women learn to internalize negative and conflicted ideas about what it means to live as a woman.

"Other(s)" – A group, community, or society with supreme authority.

Patriarchy – A family, community, or society based on a system or governed by men; a society where authority is vested in males through whom history, power, and authority are traced.

"Self" – describes and understands humans as whole and unified; whereas *self* is understood to be fractional and disjoint.

STEM – An acronym for Science, Technology, Engineering, and Mathematics

Subjectivity – "[S]ubjectivity is…thought to be nonunitary or active and continually in the process of production within historical, social, and cultural boundaries" (Bloom, 1998, p. 4). Subjectivity is the conscious and unconscious thoughts and emotions of the individual, her sense of herself and her ways of understanding her relation to the world.

"Truth" – That which is considered to be the supreme reality and to have the ultimate meaning and value of existence. 'Truth' indicates that universal facts exists to describe, define, and understand everything.

Unitary Subjectivity – People are thought to have "an essence at the heart of the individual which is unique, fixed and coherent and which makes her what she is" (Weedon, 1987, p. 32). Such claims for the existence of a unique, fixed, and coherent self in humanist ideology deny the possibilities of changes in subjectivity over time; mask the critical roles that language, social interactions, and pivotal experiences play in the production and transformation of subjectivity; and ignore gender as a social position that influences the formation of subjectivity.

Summary

In this study, I worked to translate the experiences of women natural science community college faculty. It is through this translation and interpretation that we will be able to draw several conclusions. I shed light on how these women's experiences are models for others in science to learn. I also worked to make meaning of the nonunitary subjectivities these women navigate in their professional and personal lives. It is my desire to raise compelling questions for future research about the ways that women negotiate within the natural sciences.

In Chapter 2, I review a broad milieu of literature to lay a foundation for the importance of this research. Through this literature review I am able to situate and provide evidence for the lack of research and attention dedicated to the lives and experiences women natural science faculty at the community college. I am able to position community colleges as valid sites for this kind of scientific research.

In Chapter 3, I present a detailed explanation of the general methodological framework that was used in this study. Included in this chapter is a discussion of the philosophical assumptions, research approach, data collection and analysis procedures, researcher positionality, and ethical considerations of this study.

In Chapters 4-6, I present detailed profiles of each of the three participants through their narratives. I discuss nonunitary subjectivity for each respondent.

Chapter 7 is the analysis of the data where I shape the chapter around discussions related to this study, implications for future research, recommendations developed and finally draw conclusions from this research. I re-examine my research assumptions and discuss the limitations of this study; I offer a reflection on the research process.

Chapter 2 Literature Review

"The biggest responsibility is to teach the nature of science to future scientists and also to students who will not be scientists, but who will need to function in the world with science."

Liz Dorland, Co-Principal Investigator, "National Community College Conversation: What Does It Mean To Be Educated in the 21st Century?" as cited in "Teaching by choice: Cultivating exemplary community college STEM faculty."

In this chapter I review the literature pertaining to natural science women faculty of the community college. I share some of the findings and statistics found in the literature to develop a framework for my study. I examine not only the literature relating to this research but I also note the gaping absence of research pertaining to my area of study.

Community Colleges as a Site of Research

Over the years, community colleges have enjoyed substantial growth within their student body. Amazingly, colleges continue to grow and expand at an ever increasing rate. Cohen & Brawer (2006) look to several statistical sources (NCES: 06) to announce that "enrollment [at community colleges] increased from just over five hundred thousand in 1960 to more than two million by 1970, four million by 1980, nearly 5.5 million by the end of the 1990's, and over six million by 2005" (p. 43). The faculty teaching at community colleges are generally 'young' with approximately 69% of it being 54 or under years old with approximately 70% in that age group teach natural sciences and engineering areas; further approximately 77% of the community college faculty 54 or under are women (Hardy & Laanan, p. 799). Apparently the climate at the community college is ripe for learning and instruction.

In a time of stringent financial restrictions being placed on our institutions of higher learning, community colleges have an increasing perception for having "good

value." This value may be rooted in the sense that community colleges are more affordable than their university counterparts; hence, community colleges have more "value for the buck." On the other hand, this value may correspond to the notion that community colleges generally offer smaller classroom sizes and smaller instructor-to-student ratios than their university counterparts. Further, from a student's perspective, community colleges are often viewed as easier, less rigorous, and less academically challenging compared to their four-year institution counterparts. Statistically we find that, "of the nation's nearly 14 million undergraduates, more than 4 in 10 attend two-year community colleges" (The Secretary of Education's Commission on the Future of Higher Education, 2006, p. xi). In the complex economic times of the year 2009 I would easily believe that this number (4 in 10) will substantially grow based on increased enrollments at our nation's community colleges. Although rising costs for our educational institutions generally translates into higher tuition bills for students, the American community college will continue to provide quality education for those entering its halls. "And as long as the community colleges remain accessible and relatively inexpensive, they will remain attractive not only to people seeking education but also to corporate managers and industrialists" (Cohen & Brawer, 2006, p. 449). All of these perspectives perpetuate and fuel the notion that community colleges have "good value."

It is well documented that community colleges place their emphasis on teaching, with the student at the center of its mission, while universities consider research their primary responsibility and teaching secondary (Cohen & Brawer, 2006; Grubb, 1999; Rifkin, 2000). Indeed, "the faculty is the very heart and soul of the American community college" (Hardy & Laanan, p. 787). But what is known about women community college

science faculty? There is not an easy method to find and interpret statistics regarding the number of women faculty in the natural sciences. The National Center for Education Statistics (NCES QuickStats on 10/6/09) interprets 2004 data stating that approximately 14.4% of the postsecondary natural science faculty across the country are women. Further; 17.4% of the natural science faculty teaching at the 2-year level (community colleges) are females while approximately 12.8% of the natural science faculty teaching at the 4-year level (universities) are females. We can see that women continue to find an unbalanced representation within the faculty of the natural sciences at our educational institutions. These statistics further lead us to understand that there must be influences that move more women to teach within her natural science discipline at the community college rather than at the university.

With such a large proportion of women faculty, and specifically women science faculty, one might assume that plentiful research abounds which examines the community colleges, and their roles, responsibilities, and motivations. "One reason for the lack of attention to women community college faculty is that community college faculty in general are not often studied" (Townsend, 1995, p. 40). If women community college faculties are understudied, then women community college *science* faculties are researched far less. The leading quarterly publication documenting research directed at community colleges is *New Directions for Community Colleges*. In the years 1991 to 2001, there was but one issue of *New Directions,* "Gender and Power in the Community College" (1995), that devoted itself to studying issues of women, their roles, and power, within the community college system. That issue's eight articles primarily discussed how gender socialization results in stereotypes that usually operate to women's disadvantage

socially, politically, and economically. Although that issue was devoted to issues of women and power only one of its articles (Townsend, 1995) focused on women community college faculty. Almost 15 years earlier, *New Directions* published one other quarterly (1981), "Women in Community Colleges," which contained two chapters about women faculty. One of those chapters (Averill, 1981) focused almost entirely on the humanities rather than women faculty; the other chapter (Price, 1981) asserted that women in the community college do not have equal status with men faculty for a number of reasons, most of which pertain to all women, not just faculty.

In the summer of 2002 *New Directions* published an article which explored the perceived conditions of women community college faculty members (Hagedorn & Laden, 2002). This article concludes that "the climate at the average community college may be friendlier than at four-year institutions; however, women faculty at community colleges are not free from the confines of glass ceilings, academic funnels, or discrimination" (p. 69). Although this article contains a nice literature review, it did not spotlight personal narrative experiences of women community college faculty. Six years later *New Directions* published two articles related to women faculty at the community college in the summer of 2008. The first article, by Lester & Lukas, examines the involvements, perceptions, and experiences of faculty in shared governance emphasizing the differences between men and women. The key points investigated in this article highlight the governance processes and gender roles within those processes at the community college. The second article in the summer 2008 issue of *New Directions*, by Townsend, was quite interesting. In this article, Townsend assessed the extent to which community colleges are gender equitable as compared to an article the author wrote in

1995. Townsend describes her current interpretation of gender relations and gender equity. Although an occasional article relating to women and their issues is published in *New Directions*, this quarterly publication has devoted much more of its attention to issues of students, administration, finance, and transferability rather than to women faculty. There is certainly a lack of research documenting the life experiences, understandings and interpretations of women community college natural science faculty in the leading quarterly publication devoted to researching the community college.

Although there has been an abundant research pertaining to postsecondary faculty its primary focus is on those teaching at 4-year institutions (DiGeorgio-Lutz, Hardy & Laanan, p. 788). Within these research studies topics examined include promotion and tenure, job satisfaction, assessment, retention, teaching outcomes, learning styles. These research projects certainly contribute to the body of knowledge that we have regarding postsecondary faculty. But there continues to be voices completely missing from this research. Since these research projects primarily focus on faculty at 4-year institutions then they clearly continue to perpetuate the invisibility of community college faculty. Although the underlying premise of research projects focusing on those that teach at the 4-year institution is that we should be able to extrapolate and apply their research findings to faculty at the community college, I suggest this is a false assumption. Are the life experiences of faculty at institutions primarily focusing on research the same experiences as faculty at institutions primarily focusing on teaching and learning? Certainly not. I agree with Hardy & Laanan (2006) when they write:

> A fundamental issue, though, is not addressed. It concerns the extent to which the characteristics and values of the community college environment are uniquely

> different from the characteristics and values of a 4-year college or university. Likewise, the expectations of faculty in these two vastly different institutional contexts are different. (Hardy & Laanan, 2006, p. 789).

America's community colleges are seemingly the neglected stepchildren of postsecondary educational research. The blatant omission of research directly pertaining to the important infrastructure of community college teaching separates women community college faculty from their counterparts at the university. This separation—marginalization—is further augmented for women that teach within the natural sciences at community colleges.

Women community college science instructors have been thrice marginalized. They are marginalized first because of gender; second, because they are community college faculty; and third, because they are outside elite science. Barbara Townsend, (1995) claims, "because women community college faculty are understudied, we do not know how they perceive their position within the institution" (p. 39). She develops the idea that women community college faculty are "marginalized at the margin":

> Comprising almost half the institution's full-time faculty, women faculty would seem to be in the mainstream in community colleges. However, those who study the professoriate view the high numbers of women community college faculty as evidence of the marginalization of women as faculty. Implicit in this perspective is the view that the community college is a marginal institution, operating outside the mainstream of higher education. Those who teach in it are second-class citizens in the academic world. From this perspective, women two-year college faculty are marginalized at the margins: as women they are automatically

> marginalized and as faculty, they are marginalized by working in the community college. (Townsend, 1995, p. 39)

As science faculty, however, women community college faculty experience one more layer of marginalization: from science and their "scientist" identity. Being thrice marginalized brings us to an understanding that it is imperative for research to be conducted on this rich group of subjects. Through a more thorough quantitative and qualitative research data base, understandings will provide motivation for us to shed light on those women within the natural science faculty at community colleges. We must examine their life experiences, the context of their perspectives, and translations of their understandings.

In the last 40 years very few research projects have surfaced which are devoted to the study of women community college faculty. In a brief article on 1972 survey data, Weekly (1974) offers a description on the status of women, reporting that 25% of the respondents reported being discriminated against at 17 different two-year schools in Maryland. Brawer (1977) profiled faculty (male and female, full time and part time) who taught the humanities. Hankin (1984) conducted two studies to determine the number of women and minorities faculty and administrators at the community college level in 1983-1984. Seidman (1985) provides insight into sexist attitudes that prohibits women from succeeding in administrative positions. And LaPaglias's (1994) examination of students, through the journaled observations of women faculty, established the faculty's awareness of culturally ascribed marginal status for both community college students and faculty. The noticeable absence of research on community college women science faculty is alarming.

The American Association of Community College's (AACC) website refers to the National Center for Education Statistics (NCES) for data regarding the full-time staff employment distribution by gender for faculty at America's community colleges. According to NCES the current distribution of community college faculty by gender are roughly the same (female full-time faculty at 51%, male full-time faculty at 49%). Clearly there are a lot of women faculty at community colleges. Given this large proportion of women, one might expect this particular group to represent a large research pool. Let us examine, through a fast ERIC search, current research being conducted about women community college faculty. Between the years of 1966 to 1981 an ERIC search pulls 29 referenced articles to this topic; between 1982 to 1992 an ERIC search pulls roughly the same count (30) referenced articles to this topic; between 1993 to 2009 an ERIC search produces even fewer articles than past decades yielding only 25 articles. As I glanced through these referenced articles, a majority of them were articles studying women community college students, women as leaders (CEO's) within the community college, and gender as one of the variables within the study. Apparently women community college faculty continues to be a woefully understudied group by authors publishing within educational journals.

I began to wonder if women community college faculty might actually be on the forefront of the modern educational research horizon with full articles, books, and essays yet to be published. Thus began my search through recent published dissertations cataloged electronically across the country. It was my hope that recent dissertations might serve as forerunners for upcoming research publications pertaining to women community college faculty. My search located one dissertation about community college

science faculty, Iadevaia (1991), which examines the differences between full-time and part-time faculty in terms of student success at Pima Community College. My search located *zero* dissertations referencing women community college faculty and *zero* dissertations referencing community college science faculty. Thinking my search was too narrow I expanded the parameters to find only 64 dissertations from 1980 to 2009 referencing community college faculty in one manner or another. Generally these 64 dissertations (the latest published in 2008) relate to topics such as student success, information technology in the classroom, curriculum development, under-prepared students, on-line instruction, faculty satisfaction, adjunct verses full-time faculty, teaching innovations, faculty activities within the classroom, and issues of diversity within the community college classroom. The experiences of women community college faculty, much less women community college faculty in the natural sciences, have been grievously omitted from the horizons of current educational research.

With such a noticeable absence of research pertaining to women natural science community college faculty we must explore reasons why such research would be important to conduct. In light of the fact that we are in an age of exponential growth within scientific, technical, engineering, and mathematical (STEM) areas we surely need to build a stable workforce to sustain America's productivity and economic strength. To build this stable workforce would imply that we need a stable instructional staff dedicated to the development, education, service, and scholarship of students within STEM fields.

> We live in a world where STEM expertise is becoming increasingly important not just at the highest levels but across a wide swath of industries and job titles. Community colleges, "can do" institutions committed to problem solving, are

> leading innovative efforts that involve industry, business, and other education sectors to resolve the complex challenges of educating and training STEM students in the United States. One of the critical factors affecting the community college role in STEM education is the recruitment and development of community college STEM faculty. Community colleges face enormous challenges as they strive to find and retain qualified educators in the high-demand STEM fields. (Teaching by choice: Cultivating exemplary community college STEM faculty, p. i)

If a strong STEM workforce is to be ensured, then it is imperative that we come to understand how to encourage and develop STEM talent. To address this, we must take every research opportunity to examine the lived experiences and narrative translations of women natural science community college faculty to better understand things that attracts and repels them within their STEM disciplines. This type of research will help us to create an institutional and STEM departmental culture that will nurture and develop the talents of all future participants.

Another important reason for studying women natural science community college faculty rests in the shear numbers of students, particularly women students, attending America's community colleges. "Community colleges serve close to half of the undergraduate students in the United States, which included more than 6.5 million credit students in the fall of 2005" (AACC, 2008). Approximately 61% of the students enrolled at the nation's community colleges are female (AACC, 2008). The American community college provides a welcoming environment for postsecondary education for students -- particularly women students. Since 1985, more than half of all community college

students have been women (AACC, 2008). Quoting Dr. Ellen Duncan, president of Howard Community College in Maryland, Kathleen Manzo (2000) reports,

> Many community colleges are equipped to start women, minorities and people with disabilities on the road to careers in science, engineering and technology because of their strong transfer programs. The community college is a great start because they can try out different areas to see what they like, they are more likely to have smaller classes, and they are more likely to see women and minority role models in the faculty. (Manzo, p. 2)

Since women are being told that community colleges are a great place to start their educational aspirations, in part because of access to women and minority role models, then an immediate need arises to develop knowledge and understanding of those who act as role models. We need to understand who the women community college natural science faculty are.

Summary

Although community college science faculty were once themselves students being steered and encouraged to enter STEM fields, what has been made clear is the dearth of research that specifically examines issues surrounding their multiplicity of identities. It is, then, the *absence* of data about women community college science faculty that is the impetus behind this study. If the thrust in education today is to encourage young women to enter nontraditional (STEM) fields of study—specifically chemistry, physics, biology—then we need to examine life experiences of women participants currently within these areas. Let us look into their lives and see what can be learned from their understandings of their relationships, struggles, and dilemmas. What brought them to

science? What influenced them to be teachers? How were they brought to the community college system? In order to increase the number of women involved in science, then one way to understand *how* to entice women into science would be to look at those who are already there.

We can research these questions by examining how community college science faculties understand their experiences. This research will examine the experiences of full time women science faculty. Gender, instructional discipline, and employment status were tools of differentiation when searching for respondents in this study. Further research on women community college science faculty should be developed in order to more fully understand and empower this faculty's strengths and abilities. It is important to view their experiences through lenses that differentiate them in terms of martial status, age, educational achievement, sexual orientation, family choices, race, and ethnicity. In the future, research should be developed which taps further into the multiplicity of experiences that women community college science faculty have.

Because the research on women community college science faculty is essentially absent, I draw on my own experience as a full-time community college physics faculty member as well as on related research to paint a picture of the professional lives of the women who participated in this research.

In the next chapter I share the methodological aspects of this study. Chapter 3 outlines the methodology, philosophical assumptions of this study, the research approach, information on the participants, data collection and analysis procedures, trustworthiness criteria, delimitations, limitations, and finally researcher positionality of the study.

Chapter 3

METHODOLOGY

"We don't see things as they are, we see things as we are."
Attributed to Anais Nin, French-born American writer, 1903-1977.

The purpose of this research is to look into the lives of women community college natural science instructors to better understand how they make meaning of their multiple identities as well as the events, influences, and forces that brought them to their faculty roles at the community college. This chapter outlines the methodology, philosophical assumptions of this study, the research approach, information on the participants, data collection and analysis procedures, trustworthiness criteria, delimitations, limitations, and researcher positionality of the study. Prior to collecting data, applications to conduct research involving human subjects were submitted to the Office of Research Compliance at Iowa State University. I received approval for this study from Iowa State University.

Qualitative Approach

To achieve the purpose of this study, I embrace qualitative methodology in order to unearth a rich field of understanding about these women's voices, lives, and stories. Qualitative research involves the use of narratives, content, discourse, along with other strategies to reveal insights and data. A qualitative research utilizes the approaches, methods, and techniques of feminism, ethnographies, interviews, and participant observation (to name but a few). The multimethod nature is what distinguishes qualitative research; its focus involves an interpretive and naturalist approach to gain understanding, knowledge, and meaning.

Inherent to qualitative methodology is the collaborative aspect between the researcher and the respondent. I believe qualitative research calls us to new depths of collaboration between the researcher and those being researched. In narrative research, the process of listening, interpreting, analyzing, and writing can be made more complete, and more fulfilling for both the researcher and the respondent, if collaboration is taken to a higher degree. We must not neglect the inherent nature of collaboration between researcher ad respondent: the relationship is based on the fact that there is an unspoken unequal dilemma of power (see Wong, 1998). This hierarchical relationship is an important issue that needs to be further examined. In his discussion of the evolution of qualitative research in the American educational research community, Eisner proposes a redefinition of collaboration between the researcher and the teacher:

> The feminists were among the first to call our attention to status differential between researchers and teachers in the conduct of research and the cost of such differential in really finding out about the situations we wish to understand. As a result, we have been urged from many quarters to regard teachers and school administrators not as subjects (a very telling term indeed) but as partners in a common enterprise, an enterprise that recognizes the distinctive contributions that different individuals working in different sectors of the educational enterprise are capable of making. Insider knowledge, or in anthropological terms, emic knowledge, is more likely to be shared when collaboration takes place. Such collaboration, at its best, initiates with the conceptualization process and not only at the data-gathering process. Authentic collaboration, from my perspective, will require much more than good will between researchers and teachers. It will

> require a redefinition of the teacher's role so that teachers have significant opportunities—especially time—to engage in collaboration. (Eisner, 1997, p. 263)

This evolving profoundness of collaboration between the researcher and respondent can take place in many forms. In their discussion on the description of cooperative inquiry, Heron & Reason further a deeper understanding on the relationship between those being researched and those researching:

> Cooperative inquiry rests on two participatory principles: epistemic participation and political participation. The first means that any propositional knowledge that is the outcome of the research is grounded by the researchers in their own experiential knowledge. The second means that research subjects have a basic human right to participate fully in designing the research that intends to gather knowledge about them. It follows from the first principle that the researchers are also the subjects; and from the second principle that the subjects are also the researchers. The coresearchers are also the cosubjects. The research is done by people with each other, not by researchers on other people or about them. (Heron & Reason, 1997, p. 280)

Clearly a deeper collaborative involvement between researcher and respondent is on the unexplored periphery of qualitative inquiry. The time for a more imaginative, open, and thorough means by which true research collaboration can be achieved is at hand.

Meaning and understanding of the lived experiences of the participants of this research project was developed through a multifaceted collaboration between researcher and respondent. This study provided women community college faculty in the natural

sciences a venue to share their lived stories. The use of thick, rich narratives provided details of the life experiences of the participants in this study. To this end, the qualitative research approach best suited the purpose of this research.

Epistemology: Constructionism

Epistemology can be understood in the examination of our philosophical underpinnings. It expresses the ways that we come to understand the world, relationships, knowledge, and truth. Epistemology explains the "philosophical grounding for deciding what kinds of knowledge are possible and how we can ensure that they are both adequate and legitimate" (Crotty, 1998, p. 8). The epistemology that grounds this research is constructivism. Constructivism is "the view that all knowledge, and therefore all meaningful reality as such, is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted within an essentially social context" (Crotty, 1998, p. 42). Constructionism is based on the premise that truth, understanding, and knowledge are contingent upon human practices being constructed in and out of interaction between themselves and their world (Crotty, 1998). Constructionism embraces the idea that relationships are subjective, interactive, and interdependent; further, truth is multiple, complex, and not easily quantifiable (Broido and Manning, 2002). The epistemology of constructionism provided a philosophical base for knowledge claims in this research since it endeavors to make meaning, and construct knowledge, from the experiences of women community college faculty in the natural sciences.

Research Approach: Phenomenology

To explore the lived experiences of the women natural science community college faculty of this project, the research approach and strategy I chose was phenomenology. A phenomenologic research design asks meaning questions of the respondents. Questions which describe meanings, feelings, values, beliefs, and practices of those being studied are phenomenologic in nature. Phenomenologic research approach employs interviews, observations, and note-taking techniques.

Phenomenologic research focuses on the experiences of the group being studied; it values insider perspectives. Personal descriptions of experience are the primary data for this form of research. This research method values discovery, description and meaning to those being researched compared to the natural scientific notions of sampling, reliability, validity, and replicability. In this type of research there is a continual wrestling with subjectivity, positionality, and interpretation. "In phenomenological research, although the question which prompted the research began in experience from which a foreunderstanding of the phenomenon was developed, there is an attempt on the part of the researcher to allow the data to speak for themselves in spite of the researcher's predispositions" (Osborne, 1994, p. 14). The phenomenological method of research investigates the human inner world as its source of data.

Phenomenological research attempts to enter the experiences of those being researched in order to better understand those experiences from the inside via participant interviews and observations. Participant observations can be defined as useful for "studying processes, relationships among people and events, the organization of people and events, continuities over time, and patterns, as well as the immediate socio-cultural

contexts in which human existence unfolds" (Jorgensen, 1989, p. 12). The purpose of phenomenological research is to develop an understanding of the meaning of the life experiences of those being researched.

The approach to interviewing respondents in a phenomenological study is very open-ended. Although there might be a few "starter" interview questions (i.e., ideas the researcher believes is important to explore) generally there are not lists of specific detailed questions needing to be answered. If the respondent does not cover certain aspects that the researcher was interested in then the researcher has the freedom to prompt and probe for information. "The aim of phenomenological interviewing is to get as close to the prereflective experience of the person as possible by making the interview process minimally intrusive and allowing the individual's experience to present itself as spontaneously as possible" (Osborne, 1994, p. 18). It is imperative that those being researched recount their experiences to the best of their recollection without worrying about answering the 'right way'. There is an essence of naturalness between the parties. Often respondents are asked about their feelings; they are encouraged to be self-reflexive and explore their own experiences along with the researcher. This closeness within the interview process is signatory to phenomenological research. Because of the good rapport between the interviewer and the interviewee, this type of research often makes the respondents feel as if they were co-researchers with the researcher. As respondents volunteer their time and energy in the research project they quickly learn that their opinions, feelings, experiences, and understandings are valued; they come to know (and themselves value) the importance of illuminating the data. This shared exploration

continues through the analysis and interpretation phases of the phenomenological research project.

The intention of this study was to add to the body of knowledge about the life experiences of women in the natural sciences so that future sisters in the natural sciences will benefit from these respondents' insights, experiences, understandings, and truths. Drawing on a phenomenological research approach enabled me to focus on these women's own voices and to interpret emerging understandings of their life experiences.

Methodology: Narrative Inquiry

Narratives as Source of Data

According to the Personal Narratives Group (1989), "Feminist theory is grounded in women's lives and aims to analyze the role and meaning of gender in those lives and in society, women's personal narratives are essential primary documents for feminist research" (p. 4). In order to unveil the roles and meaning of gender in these research respondents' lives, I have used personal narratives, as the analytic tool. It is my goal to describe, represent, and interpret my respondents' position as women community college science faculty.

> Women's personal narratives are, among other things, stories of how women negotiate their "exceptional" gender status both in their daily lives and over the course of a lifetime. They assume that one can understand the life only if one takes into account gender roles and gender expectations. Whether she has accepted the norms or defied them, a woman's life can never be written taking gender for granted. (Personal Narratives Group, 1989, p. 5)

Personal narratives allow the researcher to "peel away" at the layered nature of respondents' lives, issues, and work. The personal narrative is a technique for qualitative researchers to better develop an understanding of the stratums of experiences. According to Susan Chase (1995):

> But it is only by listening closely to how people tell their stories that we understand how culture is at once limiting and malleable. It is only by listening closely to how people tell their stories that we hear how narrators struggle with those limits, how they stretch and bend the available discursive resources in order to make sense of their own experiences. (p. 35)

The ability to develop a deeper sense of understanding of the process by which work is accomplished, roles are developed, and positions are established is accomplished through the employment of personal narratives.

Personal narratives allow the researcher to simultaneously reveal the individual and social aspects of the respondents, the separate and unified sense of their actions, and the bound and emancipated awareness of their roles.

> [P]ersonal narratives are particularly rich sources because, attentively interpreted, they illuminate both the logic of individual courses of action and the effects of system-level constraints within which those courses evolve. Moreover, each life provides evidence of historical activity—the working out within a specific life situation of deliberate courses of action that in turn have the potential to undermine or perpetuate the conditions and relationships in which the life evolved. (Personal Narratives Group, 1989, p. 6)

Personal narratives are layered disquisitions of human position and understanding.

Personal narratives have been an essential devise to expose the nonunitary subjectivities (Bloom, 1998) of the respondents in this research. Through interpretation and thick description, we come to understand how the subjectivities of each respondent are not the stagnant and unchanging definitions as positivist theory expects. Quite the contrary! Each respondent's subjectivities are uniquely defined, with emerging processes, and evolving layered delineations. Hence we can more completely discern nonunitary subjectivities through the interpretation of personal experience narratives.

Collaborative Nature of Narrative Research

I embrace feminist methodology because of the emancipated research relationships that can be developed.

> [F]eminist methodology promises a more interpersonal and reciprocal relationship between researchers and those whose lives are the focus of the research. Feminist methodology seeks to break down barriers that exist among women as well as the barriers that exist between the researcher and the researched. (Bloom, 1998, p. 1)

Feminist methodological research unveils sites of understanding that historically have been presupposed as inconsequential. Feminist methodologies work to disclose the dominant discourse, the patriarchal nature, and the hegemonic influences in women's lives.

Clearly mathematics and physics are both very quantitative fields; these are the fields that I hold graduate degrees. It would have been more natural to many in these fields, most likely, to have completed a quantitative research project related to women natural science faculty—but it certainly would not have been better in this researcher's opinion. I have often found numerical statistical analysis to be so subjective that it

undermines that which it is describing. I would have had an extremely difficult time describing women using hard data, statistics, and numbers. Can women's experiences truly be quantified and measurable? Not to the extent that I desire to understand their experiences. To this end, the narrative qualitative research paradigm is the one that I embrace for this study. As women's experiences are multilayered and subjective I appreciate Spradley's (1979) description of what qualitative researchers do when he called it a translation. The notion of our work being a translation helps us to understand that qualitative research tools help to interpret, understand, and make sense of narratives as valuable sites of data. Through these lived and told stories not only do we become more educated but we are provided truths for the next generations of women in natural science.

Participants

There were three participants in this study of women natural science faculty at a community college. The names of the participants were changed in the reporting of their stories. The first respondent, whose pseudo name is Liza, is a community college faculty member in the biological natural sciences. She first came to the United State as a graduate student, married an American, and then much later became a United States citizen herself. Of the three respondents Liza is the only one that, at the time of this study, held a PhD in her natural science. The second respondent, whose pseudo name is Holly, is a community college faculty member in the chemical natural sciences. She was born and raised in the Midwest; she has never moved from the state that she was born. Holly earned a Master's Degree in chemistry in the Midwest, and then chose to stay close to home to raise her daughter as a single-parent. Holly has completed no coursework

toward a PhD in chemistry. The third respondent, whose pseudo name is Anna, is a community college faculty member in the physical natural sciences. Anna too was raised in the Midwest, however, she moved between Midwestern states to pursue advanced degrees in physics. Anna attempted to earn a PhD in physics but was unable to pass the preliminary examinations and therefore was forced to exit graduate school with a Master's degree in physics.

Data Collection Procedures

Participants were selected based on the criteria that they were women community college faculty in the natural sciences. One woman from biology, one from chemistry, and one from physics was chosen for interview. The three respondents taught at different community colleges. One of the respondents taught at a large community college in Missouri while the other two taught at large community colleges in Iowa. All of them had been in the field of teaching for many years. Two of the respondents were married with children; the third was a single parent raising a daughter.

Each respondent was interviewed over the course of a year's time. During the official interview sessions I met with each respondent in a "neutral" location where she was free to talk without interruption and without fear of consequence. Each of the three respondents was interviewed in depth four times over the timeframe of a year. Each of these individual interviews lasted approximately three hours. These official interviews were audio taped on cassette tape. Two interviews were conducted and then later two more interviews were conducted in for each woman. There were no interruptions during the interviews.

I used a private office separate and apart from home, school, children, friends, and students. The official interviews took place in this office; it was a wonderful place because we were free to talk, discuss, laugh, cry and experience absolutely no interruption. We were fortunate to not experience any electrical disruptions and all conversations were fully recorded.

As data was collected from the interviews and the transcripts were being typed, several questions arose which needed clarification from each of these respondents. In several instances I was able to telephone the respondents and ask for points of clarification. Many of these impromptu phone conversations lasted well over 30 minutes, some as long as an hour. These unplanned phone conversations always had to take place "between" life-events related to the respondents' personal and professional lives. Although these telephone conversations were not audio taped, detailed notes were taken by this researcher and reflections upon the conversations were made.

It was also possible for me to electronically communicate (e-mail) these with respondents throughout the year. There were several instances when electronic messaging was the preferred tool of communication (especially when I needed to translate and/or type some of Liza's German). These communications have been saved electronically. Interestingly the respondents did not respond with in-depth answers to my electronic messages. They each responded with their specific replies to my inquiries, but they did not elaborate or go into further personal reflection when they had to type the words themselves.

The detailed documenting of the conversations, interviews, and messages allowed me the assurance that the research being conducted was relative to the participants'

experiences and understandings and as free as possible from my own research subjectivities. The interviews were conducted with general probative questions and the respondents were free to self-direct the interviews. The freedom to express personal experiences, tell stories, and interpret their positionality proved to be quite valuable to the respondents of this research. These participants seemed genuinely interested in the research project and the recompense it afforded them. The interviews, conversations, and messages conducted in this research project created an intimate venue for the respondents to give a voice to their life stories, interpret their experiences through reflection, and narrate their diverse subjectivities.

Data Analysis Procedures

Qualitative data refers to the ability to translate words, actions, stories, and experiences into written form. Qualitative data is derived from real people with real narratives and multiple subjectivities. "Essentially, a raw experience is converted into words, typically compiled into extended text" (Huberman & Miles, 1994, p. 429). In a narrative qualitative research project such as this there are lots of words thereby creating a lot of data! Through thick data description I believe this researcher was able to reveal thick interpretations from these life stories and experiences.

Accounts of personal experience can be treated in a variety of ways. The different methods of analysis "range from unstructured impression descriptions … to systematic thematic analyses employing tabular presentations of data" (Osborn, 1994, p. 5). Whatever descriptive approach is employed, the investigator of a narrative qualitative research project employs both a high level of sensitivity and a high level of writing skill.

I drew on Osborne's 1994 discussion to provide the basic tools for conducting the data analysis. Osborne summarized his thoughts:

> The researcher identifies all the themes in the protocol for each participant then sorts them into thematic clusters which are then sorted into higher order clusters in much the same way as in a rational factor analysis. This stage of data analysis constitutes a within person's [*sic*] analysis. When such analyses has been conducted for all participants, an across person's [*sic*] analysis abstracts the shared themes to form a pattern or structure of the phenomenon. (Osborne, 1994, p. 5).

Osborne continues his explanation of basic data analysis procedures by describing the final structure of the data analysis of a phenomenological study:

> Such thematic abstraction is a disjunctive rather than a conjunctive procedure in that every aspect of the common experience may not appear in the protocol of each participant although it should fit with every participant's experience when the final thematic synthesis is presented to each participant for validation (goodness of fit). The final structure is usually synthesized into a description which captures the essence (meaning) of the phenomenon. (Osborne, 1994, p. 5).

Within this research project I was able to find patterns, themes, and categories which emerged from the narrative data in my analysis. To the extent that it was possible these patterns, themes, and categories were not imposed upon the data by me, the researcher, rather, they were revealed through many hours of examination, analyzing, rereading, and interpreting the words.

In a phenomenological study such as this, the narratives are held to serious inspection. My role as the researcher was to locate categories and relationships in and between the respondents' lived experiences. Janesick (1994) summarizes Denzin's bracketing of data through the following steps:

1. Locate within the personal experience, or self-story, key phrases and statements that speak directly to the phenomenon in question.
2. Interpret the meanings of these phrases as an informed reader.
3. Obtain the participants' interpretation of these findings, if possible.
4. Inspect these meanings for what they reveal about the essential, recurring features of the phenomenon being studied.
5. Offer a tentative statement or definition of the phenomenon in terms of the essential recurring features identified in Step 4. (p. 215)

Janesick's (1994) development of the metaphor between dance and the qualitative research design was very helpful to me as a qualitative researcher. She helped me to envision a research design where every note - narrative, motion - minute, step - style, equipment - experience, choreography - culture, space - subjectivity or person - participant is valued and valid (p. 217). Just as a passionate dancer hopes to convey meaning and interpretation to the music she hears, the qualitative researcher is obligated to passionately bring meaning and interpretation to those whom she studies.

Early in the data analysis of this project I created a system of coding and categorizing the complex and layered responses these participants provided. Specifically, immediately upon transcribing the data I began to keep a series of notes. Some notes were written directly within the margins of the narrative data (a fitting location I mused).

Other notes were kept in a notebook where I was able to organize, reorganize, and further systematize the written words. There was a lot of colored highlighting conducted throughout the data itself. These highlights helped me to sort out a variety of themes within the data.

I believe the longevity of this research has given this research many opportunities not afforded to other typical dissertation research projects. The long time interval from start to finish of this project allowed me an ability to carefully consider the narratives and their meanings; further, it allowed an uncovering of the layered subjective experiences in the lives of women natural science community college faculty.

Trustworthiness Criteria

Completely different from a quantitative research project, the notion of "validity" is questioned in a qualitative research design. As a quantitative project expresses its concern for the "truth" or "falsity" of its findings in terms of internal validity, external validity, reliability, and objectivity a qualitative research project argues for different standards by which the quality of the findings are to be judged. The qualitative research project expresses the "truth" or "falsity" of its findings in terms of credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). The qualitative research project's alternate criteria for judging the research findings are somewhat analogous to the quantitative project, yet they better reflect the basic underlying assumptions grounding the qualitative project. These four criteria serve as a guide through the qualitative research project albeit the never ending issue of methodological correctness verses research validity always lingers.

The credibility criterion is established in a qualitative research project through the reporting of credible and believable results through the experiences of the research participants. Since the purpose of this research project was to describe the life experiences of natural science community college women faculty, then only those participants are the ones who can legitimately judge the credibility of these research results. Lincoln & Guba (1985) argue that ensuring credibility is one of the most important factors in establishing trustworthiness.

Using methods of member checking, I have been able to establish credibility in this research. Member checking takes place throughout the qualitative research project; some member checks are done 'on the spot' while others are done at the end of an interview session (Merriam, 2002). As respondents are asked to read through the transcripts of the interview sessions they are asked to verify that their words actually match what they intended them to be.

Throughout the project I utilized member checks with the respondents in order to accurately interpret my findings. Each respondent was given the opportunity to review the transcripts from each interview; they were asked to read through my writings throughout the whole research project. It was interesting to observe how the three respondents reacted differently to member checking procedures. Anna barely glanced through the transcripts and writings, Liza read the transcripts but did not want to ready the analysis, and Holly read through all of the transcripts and the analysis. Clearly the reaction to member checking in this project underlines the complete "uniqueness" of each qualitative research project and participant.

There are other methods which established the credibility criterion of this research project. First there was--and has been--a "prolonged engagement" (Lincoln & Guba, 1985; Merriam, 2002) between the respondents and myself. Not only did the interview sessions and data analysis components last over a long interval of time, but I have also continued to maintain contact with these three respondents throughout the years. Second the sampling of natural science faculty came from different institutions and different scientific fields. Last I used peer debriefing techniques in order to question and comment on the research as it was emerging.

Transferability refers to the degree which the results of the qualitative research project can be appropriated to other contexts or settings (Merriam, 2002). One way that the transferability criterion was satisfied in this project was through the thick rich descriptions of the collected data. My goal was to describe the life experiences of community college women faculty in the natural sciences to better understand how they make meaning of those experiences, events, and influences. This rich description of their lives "transport[s] readers to the setting and give[s] the discussion an element of shared experiences" (Cresswell, 2003, p. 196). The qualitative researcher's role is to do a thorough job of describing the research context and the assumptions that were central to the research (Jones, Torres, & Armino, 2006). The person(s) wishing to "transfer" the results to a different context is then responsible for making the judgment of how sensible the transfer is.

The quantitative research project roots its validity on the replicability of the results. The qualitative research project, however, embraces the notion that we cannot actually ever measure the same thing twice. To this end, the qualitative research project

embraces the dependability criterion in an attempt "to account for the ever-changing context within which the research occurs" (Trochim, 2006). To establish the dependability criterion in this research project I have described the processes in detail used within this study. The use of member checks throughout the research process lends itself toward validating the dependability of the research.

Qualitative researchers bring unique perspectives to their studies. The confirmability criterion refers to the degree to which the results of the qualitative research project could be confirmed or authenticated by others. One of the dominant ways to establish confirmability is the confirmability audit, or audit trail (Lincoln & Guba, 1985). I created such an audit trail for this project. I created multiple notebooks for each respondent, I have saved all of the audio tapes from the interviews, I have printed and collected all electronic messages related to this research into a notebook, I have also saved my journal of personal notes and writings from this study.

Delimitations

As noted in chapter 1, this research project took place in the Midwest. All interviews, member checks, and data analysis took place in the Midwest. Another delimitation of this study is that the topic investigated was just natural science faculty at the community college. This research within all community college faculty is yet to be explored.

Limitations

Care should be taken to not over-appropriate the findings of this research to other disciplines, faculty, or institutions of higher learning. The respondents in this study were identified by the field they teach, the geographic closeness of their community college

institution, and their gender. To assume that the findings of this study would have applicability to community colleges in another region or in other arenas of higher learning would be questionable.

Researcher Positionality

It is important as the researcher in a qualitative project that I accept the fact that there is no value-free or bias-free design. "I" am always a part of the observation, translation, analysis, and discussion within this project. I have personal biases and subjectivities that I view all events. My lens is different from other lenses. Within this project I am both an insider and an outsider. As an insider, I too teach within the natural sciences at a Midwest community college. As an outsider, I am not the respondent – I can only interpret and translate their responses and experiences through my own understandings. As an insider I can identify and hopefully well describe the understanding of these respondents to their experiences; as an outsider I lack objectivity. I believe there are power structures that manipulate and marginalize the women of this research project.

Positionality has been addressed in interpretivism, feminism, and poststructuralism. Choi summarizes saying, "interpretivists use as a catchphrase 'researcher as primary research tool,' whereas feminists frame positionality in the 'personal-as-political' principle, and postructruralists believe in 'positionality as a tool for deconstruction'" (Choi, 2006, p. 437). The more I analyze my position through these perspectives, the more I wrestle with confusions and skepticism regarding the notion of research.

To the best of my ability I have established the trustworthiness of this research through in-depth interviews, prolonged engagement with the respondents, observation, member checking, and time in the field. These techniques constantly probe the relationship between the researcher and those being researched. It is imperative that I disclose that the three respondents of this research were each, at one time or another in my life, considered close friends. Although time, geography, and work situations have changed over the many years that I have known these women one thing remains constant: we are still friends. Is this bias allowed? Do I taint my own research findings? I believe that the closeness between this researcher and the three respondents has allowed me a closer examination of their life experiences and allowed me a fuller depth toward the translation of those experiences. Experiences are constructed through relationships. My role, as researcher, was to study, narrate, and interpret the experiences of these three respondents– my friends. Studying these women has led me to studying myself.

Summary

The purpose of this study was to look into the lives of women community college natural science instructors to better understand how they make meaning of their multiple identities as well as the events, influence, and forces that brought them to their faculty roles at the community college. This chapter provided the methodological framework that was used in this study. The foundational characteristics and principles of a qualitative research project were presented in order to establish the foundation for this study, including the philosophical assumptions, the research approach, methodology,

participants, data collection procedures, data analysis procedures, trustworthiness criteria, delimitations, limitations, and researcher positionality.

Chapters 4-6 is dedicated to presenting and discussing the life experiences of the three women who participated in this study. These narratives allow readers to gain a deeper understanding of who these women are as individuals, as faculty, as students, and as family members. The experiences translated in this research allow readers to gain a deeper understanding of applicability toward future women's lives, roles, and experiences as natural science faculty.

Chapter 4
Participant Narratives: Liza's Story

"Below middle size, fair, countenance not particularly expressive except eyes which are piercing. Short-sighted. Manners the simplest possible. Her conversation very simple and pleasing. Simplicity not showing itself in abstaining from scientific subjects with which she is so well acquainted, but in being ready to talk on them all with the naiveté of a child and the utmost apparent unconsciousness of the rarity of such knowledge as she possesses, so that it requires a moment's reflection to be aware that one is hearing something very extraordinary from the mouth of a woman."
J.D. Forbes, 1831, on his impressions of Mary Somerville, (O'Connor & Robertson, 1999).

The purpose of this research is to look into the lives of women natural science instructors at the community college to better understand how they make meaning of their multiple identities as well as the events, influences, and forces that brought them to their faculty roles at the community college. By conducting individual interviews, collecting extensive narrative descriptions of their life experiences, and analyzing the transcripts of the interviews, data was gathered to answer these questions. This chapter begins with a short participant profile section followed by the findings and narratives of the first respondent. Chapter 5 will follow with the findings and narratives of the second respondent and lastly chapter 6 continues with the findings and narratives of the third respondent.

Participant Profiles

A total of three women natural science faculty members from the STEM fields of biology, chemistry, and physics participated in this study. Pseudonyms were selected for each respondent. All participants were full time faculty at their perspective institutions. Each participant, at the time of the interviews, had been teaching full time continuously and employed at a community college. One of the participants, Liza, had already earned

a doctorate in her natural science discipline whereas the other two respondents had earned master's degrees in their natural science disciplines at the time of the study.

For the remainder of chapter 4 I would like to focus an examination upon my first respondent whose pseudonym is Liza. Liza's educational focus was within biology. She was born in Austria but she came to the United States to work and study. Liza has a PhD in Biology, she is married with two children. At the time of these interviews, Liza had been teaching full time at the community college for 8 years. Liza's story is compelling and insightful. Toward the end of chapter 4 I conclude with a discussion about Liza and nonunitary subjectivity.

Liza

Liza was born and raised in Austria. She has a wonderfully distinct German accent; it is intriguing to listen to her talk. Liza is a high-energy person and, by her own admittance, claims to have "too many irons in the fire." She is an inventive, intelligent, motivated and beautiful woman in her mid 40's. A perky manner and a sharp dress are characteristics of her physique. In the early spring of the year 2000, Liza became a citizen of the United States after living in the country for 20 years. She joked that the reason she made this decision was because she was tired of her children calling her an "alien." Conversation with Liza is always lively and stimulating.

Liza has a very powerful personality. She is a zealous voiced, strong willed and deeply driven person. She is a woman of whom others have said, "always gets what she wants." Some, including Liza, have termed her arrogant. Her intelligence is never in question; she has a PhD in biology from a prestigious European university. Her

authoritative intonations, and the sharp cadence of her persona, in many ways, mirror the traditional scientist genre. They are, on the other hand, not immediately associated with the axioms defining neither a traditional woman nor a conventional teacher.

To understand how Liza (a scientist-gone-teacher) continually constructs her identity is to understand how she negotiates her identity as a *woman*. In her struggle to define and redefine self, Liza has operated primarily through discourses of power and power relationships. According to Liza, the times in her life when she successfully resisted power restraints were the times that she felt "independent." Conversely, the times in her life when she did not believe she negotiated successfully within power structures were times she defined as "dependent." Issues of power, and Liza's resistance to power, then, become sites to deconstruct her subjectivities as a woman, a teacher, and a scientist.

> The focus on how discourses create subjects as well as how women resist the constitution of their subjectivity suggests that the subject is constantly in flux. Subjects do not hold power. Power is not a single possession, nor is it located in a unitary, static sense. Power is shifting and fragmentary, relating to positionings given in the apparatuses of regulation themselves (Walkerdine 1990:42). It is everywhere and nowhere. (Munro, 1998, p. 36)

Liza's subjectivities are nonunitary. They fluctuate within her negotiations and relations of power. Hence, in order to better understand her subjectivities we must first understand how she relates to issues of power.

It was essential for me, as I conducted this research, to resist categorizing Liza through traditional notions of male gender identity. I had to be mindful to refrain from

traditional social constructions that frame my preconceived understandings of gender and gender roles. Liza is by no means "traditional." How she negotiates within realms of power, and weaves her own productions of power, allows us to interpret gender and power issues through a new lens.

Liza, like the other respondents of this study, is a community college science faculty member. She is, however, unique from the other respondents because she was born and raised in Austria. It will be important to understand Liza, through what Bloom (1998) interprets from Bakhtin ([1935] 1981) as heteroglot discourses. "These socially situated heteroglot discourses are made up of a combination of authoritative and internally persuasive discourses that influence our thinking and behaviors" (Bloom, 1998, pp. 25-26). Likewise, I propose to augment my understanding of Liza through an analogous development of "heterosocio cultures." Similarly, these heterosocio cultures are made up of a combination of authoritative and internally persuasive cultural influences that effect thinking and behavior.

Liza's European heritage has greatly impacted how she interprets and negotiates within the circumstances of her life. There is a tendency to misinterpret Liza's subjectivity through Western-style notions of conformity and uniformity. It is helpful to understand European-based discourses using Harding's (1986) interpretation of the masculine, or androcentric, nature of the European ontological worldview:

> Europeans and men are thought to conceptualize the self as autonomous, individualistic, self-interested, fundamentally isolated from other people and from nature, and threatened by these others unless the others are dominated by the self. Both groups perceive the community as a collection of similarly autonomous,

> isolated, self-interested individuals having no intrinsically fundamental relations with one another. For both groups, nature is also an autonomous system from which the self is fundamentally separated and which must be dominated to alleviate the threat of the self's being controlled by it. (Harding, 1986, p. 171)

These are internally persuasive cultural influences that motivate Liza from within. As a woman, Liza struggles to challenge the status quo and resist European (male) notions of domination and isolation. However, having been raised within these contexts, her authoritative cultural influence and discourse of power—the struggle within and without—becomes central to issues emerging within her nonunitary subjectivity.

We continue to develop a better understanding of Liza through Harding's (1986) description of the masculine, or European, epistemologies:

> To Europeans and men are attributed ethics that emphasize rule-governed adjudication of competing rights between self-interested, autonomous others; and epistemologies that conceptualize the knower as fundamentally separated from the known, and the known as an autonomous "object" that can be controlled through dispassionate, impersonal, "hand and brain" manipulations and measures. (Harding, 1986, p. 171)

Through her European heritage, and her scientifically based educational background, Liza adheres to the authority of the quantitative paradigm's scientific method. She maintains an ability to separate the *knower* from the *known*. She categorically distinguishes natural sciences as "pure" and social sciences as "messy". Liza understands no credible linkage between the two worlds of science. Her sharp lines of distinction undertone discourses of a nonunitary self.

Wrestling with her understanding of the preeminence of "neutral" science Liza's splintered subjectivities are fueled. Emerging through this perception of scientific autonomy is her personal layered struggle within power relationships. Heilbrun (1988) defines power as, "the ability to takes one's place in whatever discourse is essential to action and the right to have one's part matter" (p. 18). Women are not participants within the traditional powerful discourses of science. Further, women community college faculty are not contained within the vessel of authoritative intellectual power. This omission and exclusion is what Liza battles against. Liza defies marginalization from sites of power through her assertive nature and her ability to affect situational control by direct manipulation, intervention, and influence. Liza's proclivity is to struggle within the Other (those holding power) in order to oppose her own marginalization.

Liza's power struggles are not unique. Her desires to flourish within realms of power, and at scenes of domination, are not solely reserved for males and Europeans. Through her description of Willa Cather, Heilbrun (1988) allows us greater insight to Liza as a woman:

> From her earliest years, Cather identified the powerful with the masculine; she knew, moreover, that it was power she wanted: to be a doctor, to dissect, to know, to speak with authority and assertion. She despised weak men and womanly women. At college she became William Cather in her attempt to "construct an alternative, autonomous, and powerful self," and "to avoid becoming a platitude, a conventionally assigned identity". (Heilbrun, 1988, pp. 96-97).

Liza, like Willa Cather, identified from an early age that she needed and wanted power. From her childhood experiences, Liza knew she wanted to be associated with science and to be taken as an authority figure. To this end, Liza used her early models of status and power to construct her unique definition of self in relation to organizations of power.

When Liza described her early educational experiences she spoke proudly and with authority about her European background. Clearly she believed the quality of the Austrian educational system was superior to the American educational system. Liza's sense of pre-eminence has fueled her perception of self within structures of power. She relayed to me the basics of her education in Austria:

> I had four years of grade school. And after the four years of grade school, the teacher recommends whether or not you are *capable* of going into the prep school for college, which is called the gymnasium, or, if you're going into *just* high school.

Liza's exaggeration of the words "capable" and "just" are significant. I sensed Liza identified the gymnasium as a symbol of educational power. When asked if high school was perceived as "lower" than the gymnasium she replied, "Yes, gymnasium is the highest one you can get post-fourth grade."

From an early age, Liza had been taught the value of being placed at positions and in locations of power. The gymnasium became a symbol of Other. In order to secure a location within the Other, by the age of nine, she had been taught a model of how to fight for control and power:

> Well, since I was from a fairly poor family, even I had only one "B" and all other "A"s, I was not recommended for the gymnasium. My father had a fit! And, so

> he went to the authorities…and they *have* to give you the opportunity to test into the gymnasium. So for a whole summer I studied with my father to get prepared for that test. It was a big book! And I passed with flying colors!

This experience, when she was very young, taught Liza to not accept arbitrary and excluding positions offered by society's Other. Rather, as her father taught her, it was important that she worked hard to gain entrance into prominent halls of power. The gymnasium, for Liza and her parents, represented a desired location of Other.

The moment that Liza found out she was not included in the hand-selected group of students chosen to attend the gymnasium, she found herself at the intersection of social and gender oppression. Her family and her culture had taught her that intelligent, favored, privileged, and select people attended the gymnasium. Exclusion from this selection threatened Liza's, and her parents', notion of Self. The Other (the gymnasium) represented a location of power and prestige. It was a site for the culturally and educationally elite. Clearly, as Fine (1994) stated, "Self and Other are knottily entangled" (p. 72). Liza, and Liza's parents, had a vested interest to ensure her inclusion into the gymnasium.

Even at the time of these interviews (almost 40 years after she was denied a chosen position in the gymnasium) Liza was quick to establish her Self. The retelling of these events caused her discomfort because, once again, she was reminded of Othering. Immediately after revealing that no instructor had recommended her for entrance to the gymnasium, and that she had to "test in" for admission to the gymnasium, Liza's Self compensated. She described how she viewed the overall superiority of the Austrian educational system:

> And so I was in the gymnasium, which is an eight-year program. You have 13 subjects a year. So it's, for example, you have English every day of the week, you have German every day of the week, you have math every day of the week, but then the other subjects such as biology, chemistry, physics, history, whatever, you have either one or two hours a week. So it is pretty much like you have here in college, you know.

Clearly, Liza wanted to communicate that her early educational experiences were of a greater intensity, more stimulating, and more rigorous than the educational experiences available to young people in the United States. She equated her eight-year gymnasium preparation, from ages 9 through 17, akin to the American college experience where students are generally more than 17 years old. Liza asserted her Self through educational structures of power.

It is at this point that we must be careful. It would be very easy to quantify Liza, and categorize her, through traditional notions of male gender identity. Instead, it is imperative that we diverge from a simplistic interpretation of her narrative. "Rupturing narratives allow us to hear the uppity voices of informants…who speak against structures, representations, and practices of domination" (Fine, 1994, p. 78). This is an exercise of disbelieving. Can we come to understand that Liza's exercises of power are acts of resistance and strength? In her writings about changing perspectives on power, bell hooks (2000) speaks to feminist activists breaking with the simplistic view of women's reality as defined by powerful men. "If they had exercised the power to disbelieve, they would have insisted upon pointing out the complex nature of women's

experiences, deconstructing the notion that women are necessarily passive or unassertive" (hooks, 2000, p. 93).

As we explore Liza's narrative, our tendency is to recognize male gender notions of superiority, primacy, and prominence. For Liza these notions are equated with her constructs of power. But rather than pigeonholing Liza as an "ambiguous woman", one who has become an Other, we should challenge our interpretations to embrace such "'uppity' voices, stances, and critiques to interrupt Master Narratives" (Fine, 1994, p. 75). Liza has not become an Other; rather, she is participating in its disruption. Fine (1994) summarizes the work of feminist scholars of color who write at the intersection of Self and Other. "Crenshaw, Austin, and Matsuda force readers to hear subjugated voices not as Others but as primary informants on Othering and as the source for radical rethinking of the law" (Fine, 1994, p. 77). We can apply Fine's (1994) analysis of "uppity voices" to expand our hearing of Liza as an instigator of gender and power disruption.

In this tone, we can better understand the importance that Liza, coming from the Austrian society, places on status labels. In her narrative, Liza spoke of an event where a gentleman caller had been admonished to return Liza home promptly after a soccer game. According to Liza, the young man replied to her father, "Of course, Herr Engineer." I inquired about the young man's usage of the phrase "Herr Engineer." Liza explained:

> That's how you are always talked to—by title—of course. If I go over there [Austria] now, and go to the grocery store where they know me, they always say "Frau Doctor." They would never—NEVER—call me by Liza or by my last name; it would always be "Frau Doctor." It would be disrespectful to call

> anything else. And I have to sign my passport as Dr. Liza VanMauren because it is part of your name; it becomes part of your name.

Because of Liza's educational background she is verbally recognized as having an elevated social status as an accomplished academic elite. Her students do not speak to her on a first-name basis. She introduces herself as "Dr. VanMauren." Labels and verbal recognitions reinforce Liza's perception of self and power. To this end, rather than hearing Liza's use of titles and labels as a code of her life, as told though masculine text, we should hear these labels as speaking of her marginalized life, a life of "deviant" behaviors, and to further understand her subversion of Othering.

During the interview process, a phrase that Liza frequently cited was, "'No' is not an answer, it's an opinion." When I first heard her say this idiom I was confused as to how she interpreted that expression. Ultimately I have come to understand that a suggestion of "no" has served as a powerful motivator for Liza. When persons in positions of power exerted their will by saying "no," Liza's immediate response was one of reaction. "No," as it had been used as a device to exclude her from sites of Other in the past (the gymnasium), became an unacceptable exertion of exclusion from power for Liza. Liza actively resists notions of Othering in her reaction to the word "no." There are many examples where the word "no" was a verbal affront to Liza's sense as an empowered self.

The first time Liza cited an incident where she used "no" as a verbal gauntlet, a challenge for combat and control of power, emerged during her description of her freshman year at a university in Salzburg. Previously, her experiences at the gymnasium caused her to believe that it was, for her, a "no-brainer" to pursue a scientific track of

study. Her quantitative scientific reasoning and methodological skills had been developed and sharpened throughout her eight years at the gymnasium. Hence, she enrolled in the university with a science-intense roster of classes. Liza described the circumstances of the coursework and workload that she carried during her first semester at the university:

> I didn't have to take history or math or any of that, I just had to take math for natural sciences that would be very statistics based basically, mainly statistics. And I had to take chemistry and physics, geology, but it was all science oriented, and that didn't bother me at all, with the exception of my chemistry exam—inorganic chemistry. The professor was quite arrogant, and that's fine, most of them were.

Extending from her experiences at the gymnasium, Liza's university model for instructional power continued to be one of arrogance. Through her experiences as a student, under the tutelage of supercilious professors, she learned how to negotiate position and operate within structures of power. She continued:

> We had oral exams; they were usually between one and two hours. We didn't have exams during the semester—that system doesn't. We had one exam at the end for the whole subject and you make an appointment with the professor. So in chemistry we only had an oral exam. And we all knew that he would have one question you could select before he starts with the general exam so that you would get a head start on it. And so he asked me what I would select, and I said, "The atomic model." And he looked at me, and he said, "Fraulein Schmidt," which means Miss Schmidt, *"Es gibt keine Frau aug der welt die das atomishe model*

> *verstehen kann. Warum nehmen Sie nicht anderes material?"* which means, "There is no woman in this world who can understand the atomic model. Why don't you select something else?"

The vivid recollection of these events was powerfully alive in her memory. The manner in which she first verbalized this experience (speaking in German) is an indicator of the long-lasting impression the instructor's demeaning comments and patronizing stance left on her. The instructor's admonition to avoid the atomic model as the topic for her exam was Liza's verbal gauntlet to reassert her own authority and power. According to Liza, "I looked at him, and you say that to me, and that's like a red flag to me! OK? And I said, 'Oh yes there is, so I am not changing my mind.'" Liza recalled how the instructor retaliated to her exertion of personal power with his own assertion of power:

> Well he went from the basic chemistry, which it was really supposed to be the basic chemistry, into what I would call high energy physics! He can flunk me on that! So he did. He flunked me. And I am going, "You're kidding, right?" Not shy, not intimidated. And he said, "No. Come back in six weeks." And we can only flunk once, and then you have a second chance, and then it has to go in front of the Board.

In preparation for her second attack, Liza regrouped and situated herself among the academically powerful.

> So needless to say, I was devastated. I mean all "A"s and then this "F". You know? I might have had a "B" in the second series in physics, but it was all good grades. I was on top of the classes. I got scholarships on a competitive basis. They were called "*begabtenstipendium"* which is out of 5000 students they pick

> ten, it didn't matter which area, which had the most credits and the best grade point average in that credit, and I was one of them, out of 5000 students. And there were those in sports, and those in English, and so I was a good student at that time! And that absolutely crushed me.

Clearly Liza had the choice to acquiesce and change topics for her chemistry exam. Rather than yielding to exertions from outside power structures, Liza was indefatigable.

> So I studied, came back in six weeks, and he said again, "*Was nehemen wir denn heute mein Fraulein?"* meaning, "Fraulein Schmidt, what are you going to take today?" You know what question. And I just looked at him straight and I said, "The atomic model." That's when he said, "You've got to be kidding!" "No I'm not." And I studied my brains out for this. Of course he could always find something…a detail, which I couldn't answer. He could always find a detail. You know, he never went into any of the other areas. He was supposed to go into the other areas, but he just stayed with the atomic model until he found a hole, which I couldn't get out of. It's very subjective.

It was only a small consolation for Liza to understand and accept that in this situation she was not the one holding power. Certainly any instructor can find conceptual details to be used as evidence of a student's inadequate preparation. Based upon her authenticated experiences of earning high marks, Liza believed she had adequately prepared for an exam that was ultimately a catch-22. Liza received her first and only "D" of her collegiate career in freshman inorganic chemistry.

It is important to read beyond the text of this experience. Liza cannot be simply categorized as a young, brash, outspoken girl who wanted to get her way on this

particular chemistry exam. Rather, we can view this scenerio through two lenses. One lens disrupts Othering, and the second contributes to her definition of self. First, Liza furthered her understandings toward strategies that disrupt patriarchal structures of power. Her rejection of the instructor's "no", as identifiable advice, is concomitant to her subversion of sex discrimination. She had not been deterred from her defiance to gender marginalization. She had challenged Other. Secondly, she learned to turn an academic catastrophe (the low course grade) into a personal assertion of self. Through this experience she was motivated to avert the instructor's regime of power and continue studying within the natural sciences. She had not been dissuaded from her academic goals. This experience contributed to her evolving definition of self and her own subjectivity.

During her second semester at the university Liza was again motivated into action and assertion through the word "no." She described her rising interest in scientific work and her intrigue at being located within structures of intellectual power. "I couldn't leave the building without going into one of the labs, you know? There was just like a sucking—you know? I loved it." She felt a drawing, a "sucking in", to scientific laboratories. She grasped that through laboratory work she could experiment with all types of reactions. In the scientific laboratory there would be opportunities available to study, learn, control, and manipulate the Other through a bio-network of humans and animals. She understood that she could gain access to sites of intellectual power through a pursuit of an advanced degree within her area of interest and specialization, that is, within the natural sciences.

> So second semester I thought, you know, I'm going to get my Ph.D. I have to. So I went to the departmental chair in zoology, and I told him that I wanted to work in the lab. And he looked at me and he said, "You're a second *semester* student? Come back when you're in the fourth *year*, when you have six semesters, under your belt, then you come back." And I looked at him, and I said, "No! I want to work in the lab! I want to start early, and I want to start as early as I possibly can." And he said, "Come back six semesters from now." So I left.

Liza's assertion of self power was met with the chairman's "no." His callused dismissal was her verbal gauntlet. She decided to retaliate and assert herself, taking matters into her own hand.

> Of course that was the wrong thing for him to do. If he would have said, "Sure what do you want to do?" I would probably have left him alone. But he said, "No." And "no" at that time was not an answer…it was just an opinion! So I had him in class and I would bug him like you wouldn't believe, and anybody else who I could get on my side, you know, any of the professors that I could get on my side. So I went back there four weeks later. He said, "I said six semesters." I said, "Well, it's just a matter of opinion." And so he said, "OK, just to get you off my back, I'll let you work in the lab. And then we'll see what lab skills you have." So I made my way into the labs.

Liza's resolve to be located at sites of power was demonstrated when she forced her way into the labs. We can interpret this to be Liza's disruption of Othering. Rarely do second semester college students gain access to employment in scientific laboratories. This

enforcement of self power helped establish her authority within those realms. Liza ultimately graduated from the university in Salzburg with a Ph.D. in Biology.

Liza's assertive behavior might be misinterpreted through the male conceptions of arrogance. However, we must be mindful not to participate in Liza's social subordination through this context. Rather, we should celebrate this great accomplishment of gender.

> To denounce women for shrillness and stridency is another way of denying them any right to power. Unfortunately, power is something that women abjure once they perceive the great difference between the lives possible to men and to women, and the violence necessary to men to maintain their position of authority. (Heilbrun, 1988, p. 16)

Throughout her educational background, Liza had witnessed models of cultural, scientific, and intellectual arrogance. These archetypes sculpted her stance for resistance. Liza practiced her personal exemplar of power through an emancipated gender identity. Again, Liza challenged Othering through her own personal assertions of self.

In her portraits of contemporary women scientists, Gornick (1983) illustrated the range of temperamental differences among the women she studied. She characterized women scientists as "occupying every position on a wide spectrum of personality types" (Gornick, 1983, p. 120). She exemplified her point that "these women seem to reveal their individual selves through science rather than disappear into science as the earlier generation of women so often did" (Gornick, 1983, pp. 120-121). One such illustration was through Lindasue Hearne, who was in her second year post-doctoral fellowship at an east coast research institution. According to Gornick's (1983) analysis,

> Shrewd, bossy, pragmatic, Lindasue Hearne is a scientist whose research serves the impulse toward "community" in its truest sense…. [She felt] part of a group with a mission, a member of a shared effort in a large ideal. She has never lost that feeling. Organizing the mission is her deepest drive. Not that Lindasue could transfer her organizing drive to political campaigns or community centers. No, it is only science that ignites her and induces in her the conviction of significance necessary to activate the missionary zeal that characterizes her. (Gornick, 1983, p. 112)

Like Lindasue, Liza's character is socially constructed as shrewd, bossy, pragmatic, and arrogant. Through this illustration, we develop an understanding that Liza's characterization as "arrogant" is a tool of power she employs to challenge and subvert her gender's disconnection to science.

After graduate school Liza found a position in the United States performing post-graduate work in biology. She arrived in this country Halloween night, 1978, at the age of 24 and began her work at Middle University. "So I went to work, and they gave me an office at the University all by myself. I was treated like a scientist. It was just stunning." The social respect and influence of scientific power were becoming apparent for Liza. Self perceptions of power and authority were affirming. To be "treated as a scientist" implied that she felt a great accomplishment of self through her disruptions of Other. Her personal tools of power (i.e., arrogance) had helped her to accrue strength within her subjectivity. Finally, as a scientist, she experienced visibility rather than marginality.

In a later interview Liza visited the subject of her decision to apply for the full-time faculty position at the North Campus of Central Community College, where she is

currently employed. Prior to that time, she had worked for the United States government doing research on the processes of aging. She had painstakingly written, and been awarded, many grants for biological research. She had been a consultant for the government and had also maintained and managed scientific laboratories. However, as a research scientist, she had never before gone through formal hiring procedures, rather, she had always been appointed to these positions in science.

> Because I really never did it except for *this* job. And for this job I didn't just apply, I *went* for it. I wanted that job. I did everything in my power to get that job. I called [the Group Chair] back I don't know how many times. I knew I wanted that job. And this interview, when I had this [job] interview, I was nervous because I wanted to do well. I had that pressure. I needed this job. I made a commitment to get this job. And I *knew* walking in the interview, there was no—I walked in with the attitude that this is my job. And [the people on the hiring committee] all knew that this was my job. That was my whole attitude.

Her self identity with power were created through stratums of assertiveness and aggressiveness, trademarks of the "typical scientist." This scientist, however, was a unique applicant. Not only was Liza's manner emblematically male but also she was replete with feminine attributes.

> Those of us indoctrinated into fields of science are taught to closely mimic the behavior of others, to be unemotional in our interactions with colleagues, and to express ourselves verbally in a traditional language established by men. Yet as women, society teaches us that creativity, emotional warmth, and intuition are valuable traits. These characteristics are the opposite of those often viewed as

> desirable by men in science and medicine. Being a woman scientist becomes a delicate balancing act in which one must exude a male-defined "professional" aura in order to be recognized as a competent scientist, while often suppressing those qualities with which one defines one's self as a woman. This struggle comprises what I believe to be the *extra* effort women must exert on a daily basis simply to be accepted as scientists. (Allen, 1998, pp. 145-146)

Ultimately, during the first week of January 1991, Liza was hired to the position for which she applied at the North Campus. She immediately began teaching biology as a full time faculty member that spring semester. Having done "everything in my power" to get the job, she believed that it was through her personal assertiveness she was hired. When I asked how she believed her insistence had been received she replied, "Well I always come across aggressive."

> As Deborah Cameron, an English linguistic theorist, has sardonically observed, male defense of its own power has decreed that nothing "is more ridiculous than a woman who imitates a male activity and is therefore no longer a woman. This can apply not only to speaking and writing, but also to the way a woman looks, the job she does, the way she behaves sexually, the leisure pursuits she engages in, the intellectual activities she prefers and so on *ad infinitum*. Sex differentiation must be rigidly upheld by whatever means are available, for men can be men only if women are unambiguously women"…. (Heilbrun, 1988, p. 16)

Again, Liza's assertive manner challenges our understandings of what is means to be a woman of accomplishment. Her assertions give testimony that, in their constructions of personal power, women do not need to be passive and unassuming.

Full time employment at the North Campus brought many new, and uncharted, experiences for Liza. Along with the newness of the teaching experience, Liza also had to contend with many new (and unfamiliar) issues involving power. She felt poorly equipped to handle this new vein of oppression by Other. Suddenly she found she was no longer acknowledged as a privileged biological research scientist; rather, she was being identified as *just* a teacher of biology. Also, her self perception of power was shaken when she realized that the scientific research community now viewed her position (and power) as something lower and outside Science.

In 1999, Liza attended a scientific conference in St. Louis that addressed issues surrounding the biology of aging. This topic was one of great personal interest to Liza. However, she found herself occupying a unique position during the conference. "I definitely was the only person from a two-year college, without a doubt. OK? Everybody else was graduate and professional. OK? Either they were teaching at a professional school or medical school…whatever." At first Liza was pleased to be the sole representative of community college faculty. Prior to this, she had not made a personal distinction of power associated with instruction at the university level versus power associated with instruction at the community college level. She had not experienced marginalization from elite science and privileged education.

> I went to small meetings before—you know that. But St. Louis was the first scientific meeting for a long time—since I quit my science career. And I actually

> felt kind of out of place at first, because there it was on my nametag, "Dr. Liza VanMauren," (because that's how they do it at conventions) but instead of "University" or "Hospital" or "Medical School", which all the other people came from, it was "North Campus of Central Community College." OK? So, the question I received, not once a day but *all* the time was, "Well, community colleges don't have research, do they?" Everybody was assuming [that] if you go to that scientific meeting you've got to be a scientist.

The power and value placed on the label "Dr." Liza had enjoyed as a research scientist, as well as on site at the community college, was not endorsed at this particular scientific meeting. Old scientific constituents did not validate her current status as one of power since she was not affiliated with traditional locations of power (universities, hospitals, medical schools). Familiar structures of power pushed Liza into the peripheral as insignificant. This isolation from her scientific group, her marginalization, made Liza very uncomfortable. She realized that Science had Othered her. In response, she defended her perception of the benefits and intellectual power one obtains from teaching:

> And the questions, which came out of the audience, which were people in a very narrow area of research, couldn't understand things I could. Simply through teaching I have learned in the past eight years such a tremendous amount of material, which I can use now and be above those researchers. I can understand the topics they can't understand. And I can inter-relate it, OK?

Liza claimed to have located, through her experience as a community college instructor, pristine sites of knowledge. Liza's self perception of power was reasserted. She claimed

authority over her research science colleagues since she could, ”inter-relate,” and “understand the topics they can’t understand.”

The questions that bothered Liza were ones pointed directly at questioning her presence at the scientific conference.

> What bothered me were the questions, you know, “Why are you here?” You know? I didn’t even defend. I was beyond that. I said, “I believe that teachers need to get updated too.” You know?

Liza had assumed her history, credentials, and past experiences were her passport to the sphere of power that she had once been included as a research scientist. Instead she found that the traditional structures of power no longer recognized her position and self perception of authority. Her retort, “I believe teachers need to be updated,” is inarguable within the dominion of education at the community college system. However, within the powerful scientific community, their view on the position of instructors led to a completely different conclusion. Liza’s decision to “not defend” (implying she was above that) and her later actions seem to conflict.

At the conference, Liza attended a symposium on Alzheimer’s disease. When Liza was in graduate school, she was the leader of a discussion group involving issues pertaining to Alzheimer’s disease. This symposium had great personal interest to Liza.

> Remember I taught Alzheimer’s disease before, so I’m quite well aware of the research which was going on. And so that one presenter, he talked about anticholinesterase…nerve agent is an anticholinesterase…and remember I spent eight years of my research career on studying the effects on nerve agents, low dose exposure to nerve agents, on the brain and the spinal cord. So there’s no

> area of the brain or spinal cord I don't know of that anticholinesterase have an effect. But anyway, I spent a tremendous amount of time and effort in that given area. And I'm published in that area.

Clearly Liza was well versed in the powerful language of her discipline. The prominence she placed on being published in that area helped her to situate and justify her attendance at the conference. Attending a scientific conference in 1999 that pertained to work she did in 1987 seemed logical.

> The interesting thing is, in 1987 I applied for a grant from the Alzheimer's Disease Foundation to look at the effects of anticholinesterase on learning and memory, and relating that to Alzheimer's disease. OK? I got turned down. I still have the proposal. I got turned down because they didn't believe that anticholinesterase could have any effect on Alzheimer's disease. I was way above my time.

Liza's choice of words is significant. Although we must keep in mind English is not her native tongue she had, however, been fully immersed in an English speaking society for more than 20 years. For Liza to use the word "above" rather than "ahead" is noteworthy. Liza's self perception of intellectual power had long been reinforced. However, after her presence at the conference was put into question, Liza's requisite rejoinder to the impulses of power was to declare Self authority. Liza attended the symposium addressing Alzheimer's disease.

> So as [the lecturer] presented, you know, he didn't tell me anything new. What he presented I already knew, but it was a hypothesis, OK? So he presented some of the data and then at the end he came up with a hypothesis that he believes

> anticholinesterase work in Alzheimer's patients or at to some extent because of the sprouting of neurons, axonal sprouting we call that, so that neurons basically make new connections.

The assertion that she "already knew" the material being presented was another declaration of Self power. The research Liza had previously conducted in 1987 seemed to be directly related to the presentation. She continued:

> And [the lecturer] said, "Unfortunately there is no methodological evidence for that." And I went *wham!* Wait a minute! BUT, and here comes the interesting thing: when I was still in science I would have *immediately* raised my hand. You know? And I would have informed the whole audience that yes this is published, yes there is evidence. I didn't have the guts. I did not have the guts to raise my hand and say it.

The research scientists in attendance at the conference had stripped Liza of her Self power and simultaneously Othered her. This marginalization caused Liza to question her location within power. Munro (1998) quotes Walkerdine (1990):

> [T]eachers are not unitary subjects uniquely positioned but are produced as a nexus of subjectivities in relations of power which are constantly shifting, rendering them at one moment powerful and at another powerless. (Munro, 1998, p. 39)

Liza had firsthand experienced the circumvolution of power. As Liza stated, "When I was still in science," she positioned herself as post-science. In this new and unfamiliar location she was rendered immobile ("I didn't have the guts to raise my hand"). This was a rare position for Liza; her inability to immediately respond was uncharacteristic.

Clearly, hegemonic scientific structures of power are influential and oppressive; they are disempowering.

One question, which might be raised, then, is "Why did Liza leave elite science?" If she felt she was a part of the large Other power structure when she was a research scientist, then why forego that cachet? I believe the answer is again in Liza's ability to commence disruption of the Other. Rather than acquiescing and continuing as a participant within the Other (as is typical of "traditional scientists"), she decided to requite and pursue science through different endeavors.

Perhaps we can better understand Liza, and her motivations, through Franks' (1998) narrative about her experiences in science, and her decision to leave research science and become an instructor of science.

> My reasons for leaving the world of research are actually based on a genuine love for science, rather than a growing distaste. I thoroughly enjoy the theoretical aspects and hands-on work of bench science: designing experiments, collecting and analyzing data, developing an interpretation, and discussing the work with other scientists. From where I stand, this work seems to be done almost exclusively by graduate students, technicians, and postdoctoral researchers. It is ironic that successful scientists are rewarded by being systematically deprived of the opportunity to excel at what they do best. The more "successful" one becomes and the further one climbs up the traditional career ladder, the less time one spends actually doing any laboratory work. (Franks, 1998, p. 129)

Franks' description allows us avenues to rethink Liza's motivations for leaving research science to become a faculty member at the community college level. Recall that as a

college student, Liza was drawn closer to science through laboratory work. Although her work experiences as a research scientist were rewarding, they were simultaneously excluding her from the activities of science that she genuinely esteemed. In that capacity, much of her time was relegated to writing grants, which in turn, deprived her time in the laboratory. On the other hand, in her position as a faculty member, she was enabled to focus on some of the aspects of science that she valued: discovery, analysis, interpretation, linking, experimentation, and discussion. In this sense, again Liza rejects the traditional and masculine version of the scientific success story. Once more, Liza averted the Other through her own assertion of power.

> Because of our marginalized status in most scientific disciplines, women are often pushed, or forced, out of those career paths in which either male competition is intense of there is a strong sense of male entitlement. It is ironic that this often places women in a more favorable position for exploring unconventional career prospects. Whereas the career risks associated with an unorthodox career possibility might be judged as exceedingly high for a male scientist, the relative risk perceived by a woman might be lower, particularly if her options are limited. As a result, women are generally much more willing to travel the career path without a map than are their male counterparts. (Pattatucci, 1998, p. 135)

Here, Pattuatucci is *not* promoting maintenance of the status quo of women's marginalization within science. Rather, she strongly advocates an unbiased and unprejudiced science through women's increasing participation within science at all levels. In this sense, she promotes women to follow the "career path without a map" in order to empower themselves in opposition to their marginalization.

In our understanding of Liza we celebrate her exceptional success as an emerging empowered woman. The culture and discourses that influenced Liza did not encourage her participation within and integration into Science. It has been through her personal opposition to Othering that she has disrupted dominant patriarchal structures.

Liza's continuing struggles within regimes of power are concomitant to the dissonance she senses for her gender. However, Liza continues to strive to make sense of her self, and her nonunitary subjectivities, through these constructs of power. She struggles to understand times when she perceives herself as independent (possessing and participating within power) as compared to times when she is dependent (not possessing or participating within power). From this internal conflict we can begin an investigation into the splintered nature of Liza's subjectivities.

Nonunitary Subjectivities and Liza

Through our understanding of Liza as one who disrupts constructs and regimes of Other power, we can commence our understanding of her as one who battles within her own senses of subjective power.

> Because each individual occupies a location in a multidimensional grid marked by numerous interacting structures of power asymmetry, the analytical task is not to determine which is epistemically most adequate. Rather, the task is to understand how these complexly conditioned subjectivities are expressed in action and belief. (Longino, 1996, p. 269)

Many times throughout her narrative, Liza referred to instances where she was dependent verses those instances where she was independent. These are indicators of the nonunitary nature of her subjectivities.

To illustrate, when Liza conducted the research for her doctoral degree in biology, she teamed up with a man (Lance) whom she ultimately became romantically involved.

> I was working very hard, I mean, we were both working hard. It was fun because we worked on similar areas. We were a real team. We would have rat colonies together! We were a team…you know, a research team. Those were good years, because of that support we had for each other. We could finish things that others could only dream about.

Liza believed she independently contributed to the overall success of this research "dream team."

In reference to her work, as well as her relationships to other people, Liza often equated it to being a puzzle—something that could be worked through and figured out. Also, Liza had discovered "science love: the love that culminates repeatedly in the special thrill that comes when an experiment yields up a significant finding" (Gornick, 1983, p. 127).

> I found I was extremely good in scanning electron microscopy. I just had the *feel* for it, you know? I always had. It was like a puzzle for me, and you know how I love puzzles! And so I would do the scanning work, and Lance would do the light microscopy work. We would discuss the findings, so it really was teamwork. But then I stumbled on something in the preparation of the specimen! When I broke the brain apart, I could still coat them with gold, and I could see the internal structures of materials. I developed the technique a little bit more so that we could see some internal structures in the ventricles of the brain and so forth. And we published that!

Initially, Liza interpreted the research team as being composed of separate independent individuals contributing to the overall work of the team. However, the advent where Liza began to reinterpret her self as being dependent was the first publication of their research findings. The team's major professor insisted that Lance's name appear first on their publication, even though the technique being developed was Liza's. Here, sex discrimination was the impetus for Liza's Othering, her loss of power, and further splintering of her subjectivity.

> Our major professor always felt that Lance's name should be first, because he was a man, and he would need it, and I wouldn't need it. That was a struggle. At that time I really struggled with that. But I was in love, so you know, I took it. And then it came to the point that I thought I couldn't do anything without Lance. I was getting really dependent on that teamwork and that relationship. I thought that he was the core of the team. You know, I was absolutely convinced that without him, I would be nothing. So that's when I became weak. That's when I became dependent. And I didn't much like it, but it happened so gradually that by the time I realized it…it was too late. You know, I honestly believed that there couldn't be a Liza without a Lance, in the research area.

Hegemonic power forced Liza to doubt her professional abilities and strengths. "In the research relationship, the way that power functions depends greatly on the interrelationship between the multiple subject positions of the people involved in the research and the different discourses about those subject positions" (Bloom, 1998, p. 34). By subverting Liza's authority within the research team, their major professor was the trigger for undermining her power. To this end, Liza's subjectivity as a researcher was

put into question. Her disempowerment and marginalization is significant because it caused her to believe she was an insignificant member of Science.

> The core of the scanning electron microscopy stuff was *me*! They [Science] always thought that a man scientist was better than the female scientist. That was a given. It was very hard for them to grasp that somebody with…as I said, I was looking pretty sharp back then, I was young, and always dressed up…everybody thought I was a bimbo. So the brains behind it [the research] didn't come out.

In hindsight, and through maturity, Liza understands that she was the "brains of the operation." However, as a young person, struggling to understand and develop her subjectivities, heteroglot discourses gave authority to traditional patriarchal power structures.

At that time, Liza was unaware that she was being discriminated against. The only interpretation that she internally understood was that she was being dependent. This disempowerment, through sex discrimination, was an affront to her scientific professionalism. We can develop our understandings of Liza position through Olsen's (1998) retelling of her experiences:

> I have been a victim of discrimination. It was not meant as an insult; as a matter of fact, these gentlemen were my friends. And yet, without stating it outright, my opinion was ignored. I have observed this behavior by men for years, and have coined it, Little Sister Syndrome (LSS). I am an intelligent, rational scientist, yet so many men choose to treat me like their little sister rather than deal with me on a peer level. LSS is rampant within academia, with women unconsciously playing the dependent role in many research groups. The problem becomes a

> crisis when a woman in a research group has a strong, dominant personality and refuses to defer to powerful males in the group. At this point, I have observed a lot of men blaming the woman, saying that she is domineering and bossy. (Olsen, 1998, p. 63)

It is easy for Science to dismiss women in their ranks as "little sisters" and as "bimbos." Both characterizations of women (little sisters, and bimbos) are used to marginalize and undermine women's authority. Without disruption, power is preserved and patriarchy is dominant.

> This underscores my central belief that self-esteem plays a crucial role in women's success in scientific endeavors. We have been told that we can become the best scientists in the world, yet we still feel the need to play the role of little sister. If we do not, and instead act confident and assertive, we are often rebuked or ostracized. This places women in a quandary regarding what role they are expected to play in life. (Olsen, 1998, p. 63)

Women find themselves in dependent and subordinate roles to which Other has relegated them. These experiences exemplify that "identity is always in formation within the nexus of power relations" (Munro, 1998, p. 37). Power's severance of the strong scientist and the weak woman is the platform for Liza's understanding of dependent. It is a central issue to her nonunitary subjectivity.

> One of the purposes of examining subjectivity in women's personal narratives is to redefine what it means for women to write, tell, discuss, and analyze their life

> experiences against the backdrop of the prevailing discourses that seek to silence them. (Bloom, 1998, p. 64)

To understand Liza's notion of dependent through the lens of patriarchal power is a means of disrupting and exposing Othering. This insight is a crucial element that can encourage women "to overcome the limitations imposed upon them by social, economic, racial, and historical factors" (Bloom, 1998. p. 64). Further, it is an agency by which women can overcome their marginalization within the gendered patriarchal power system.

Chapter 5

Participant Narratives: Holly's Story

In this chapter I would like to examine my second respondent, whose pseudonym is Holly, in great detail. Holly has a Master's degree in Chemistry. She was born and raised in the Midwest. She is a single parent to one child. At the time of the interviews, Holly had been teaching full time at a community college for six years. Holly's story will ring true to other women's experiences, and provide a rich field of validation to those working and studying within any STEM field. Toward the end of chapter 5 I conclude with a discussion about Holly and nonunitary subjectivity.

Holly

Feminist scholarship helps us, as Heibrun (1988) quoted from Miller (1988), to "articulate a self-consciousness about women's identity both as inherited cultural fact and as process of social construction and to protest against the available fiction of female becoming" (p. 18). Elizabeth Gross (1992) reminds us of the urgency that we must learn to enunciate women's lived experiences as validated forms of knowledge and truth. Otherwise, as she quotes from Irigaray (1980),

> If we continue to speak this sameness, if we speak to each other as men have spoken for centuries, as [T]hey have taught us to speak, we will fail each other. Again…words will pass through our bodies, above our heads, disappear, make us disappear. (Gross, 1992, p. 355)

The temptation is to believe that simple autobiographical scripts of women's lives will alone inscribe us in annals of Truth. However, we need to sharpen our pens and write of

previously obscured experiences. Like Heilbrun (1988), I grew up believing the essential Truth of the Rubáiyát of Omar Khayyám quatrains as translated by Edward FitzGerald (1859). A much-quoted verse (LXXI), and one which is well known from my own experiences within several physics departments, reads:

> The Moving Finger writes; and, having writ,
>
> Moves on: nor all our Piety nor Wit
>
> Shall lure it back to cancel half a Line,
>
> Nor all your Tears wash out a Word of it.

Unthinkingly, I have in the past believed this to be Truth. Unfortunately, I failed to view this writing through a feminist perspective. I have learned that we must critically examine the libretto of women's lives to expose that which is absent from the dominant discourse. As Heilbrun (1988) states,

> This [Rubáiyát of Omar Khayyám] used to seem evidently, obviously, true. But, at least insofar as women's lives are concerned, it is wrong. Lines can be canceled and washed out; and what the Moving Finger writ may, all along, have been misread. I suggest that it has indeed been misread, and that women have mistakenly supposed themselves deprived of the Piety and Wit certainly sufficient to lure it back. (p. 19)

We must resist essentializing (the traditionally male) notion of believing that once something is done it cannot be undone. We *can* change *how* we write and *whom* we write about. Therefore, as feminist scholars, we must further advance the techniques of writing women's lives in order that our transformative writing evolves, taking its sustenance from nontraditional and previously hidden stories of women's lives.

The study we are to embark upon is one that highlights Holly's actual lived experience. Rather than interpreting her experience through an abstract patriarchal patois, we will focus how Holly has *lived* her relationships in the material world. Weiler (1988) offers a comment from Stanley and Wise (1983):

> Our experience has been named by men, but not even in a language derived from their experience. Even this is too direct and too personal. And so it is removed from experience altogether by being cast in abstract and theoretical terms. We need a women's language, a language of experience. And this must necessarily come from our exploration of the personal, the everyday, and what we experience—women's lived experiences. (p. 61)

Holly's consciousness raising is grounded in her material life. Her material life incorporates commitments, responsibilities, and functions that are different from any of her male counterparts. (The patriarchal Scribe would also render such obligations invisible.) To this end, we will be allowing Holly's story to be transformed from a "conventional to an eccentric story" (Heilbrun, 1988, p. 48).

Writing Holly's life, using lived experience as guideposts of our understanding, is not an easy task. We will expose unconventional sites for knowledge and different forms of truth. In this quest, we will allow Holly's "different voice" (Gilligan, 1982) to be heard.

> I have read many moving lives of women, but they are painful, the price is high, the anxiety is intense, because there is no script to follow, no story portraying how one is to act, let alone any alternative stories. (Heilbrun, 1988, p. 39)

Holly's story is one such alternative. It is my hope that, ultimately, Holly's singular voice may ring validation and understanding to other women's experiences and truths.

Holly is in her late 30's; she is a white woman and a single parent of one child. Holly has earned a Master's degree in chemistry and, as a full time faculty member at the North Campus of Central Community College, she teaches chemistry. Holly lives in a small Midwestern town, she owns her home, she enjoys playing the piano and playing with her pets. Holly pursues a very active agenda outside of her professional instructional responsibilities. She accompanies her church choir playing the piano, she serves on the local Habitat for Humanity board, and she is actively involved with a women's group composed of mainly older, and retired, elementary school teachers. Holly was a core part of a body of Christian believers that broke its association with the city's largest church to establish a new church. Today Holly toys with the idea of furthering her own education. Some times she speaks of attending pharmacy school while other times she speaks of working on a master's degree in mathematics.

Rather than seeing the realities of Holly's own strengths and agency, the tendency is to obscure it, typify it, therefore failing to see, her individual story. If we put Holly's narrative into the blender of male hegemony and sexist institutionalism we have fallen short of our epitome, as feminist scholars, to highlight unique strands of strength that Holly weaves into the fabric of our understandings of truth and knowledge. Weiler (1988) quotes Gaskell (1985):

> There is…a tradition in feminist scholarship that has emphasized that women's consciousness is not simply an internalization of male forms but contains its own alternative interpretations, commitments and connections…. The relation

> between women's consciousness and man's world is complex and involves accommodation, resistance, and self-imposed and externally imposed silences. Correspondence does not account for their relationship. (p. 51)

Our study of Holly is not simply an analysis of oppressive practices and ideology. Rather, through an elucidation of the complex processes containing contradiction and an interpretation of various points of resistance, we can come to understand Holly as a nonunitary subjective individual.

On the surface, by most traditional accounts, Holly seems to be a very mainstream Midwestern woman. As we listen to Holly's narrative, the temptation to interpret her story through male structures *is* hard to resist. But that is exactly what we must do.

> Women, as well as men, are enmeshed in social relationships and ideological, as well as material, webs of meaning and power. But because they are oppressed by sexism as well as class, the form of their resistance will be different from that of men. (Weiler, 1988, p. 40)

We must resist, as Holly has learned to do, "boxing" our understanding of her life into compact patriarchal packages. We must look beyond the outer layer to reveal Holly's unique and idiosyncratic life experiences in order to expose a clearer understanding of truth.

Throughout her childhood, Holly was always classified as the "smart girl." According to Holly, "I graduated with a 4.0 grade point average and was number one in my graduating class." She was an academic elite and she was distinguished as one who had great potential and ability to "go far." How, then, did Holly demonstrate resistance if now she is "just" a chemistry instructor at a community college? Did she succumb and

settle for what the dominant Voice claims to be an acceptable woman's role? If we compare the vision that society held for Holly (as a young intellectual person) to the position and location that she is currently occupying, the patriarchal interpretation would say, using objective style arguments, that she surrendered her Self and acquiesced to the traditional norms imposed on women. I propose that we view Holly's story of resistance through a more subjective lens and using an interpretive mode.

As the interpreter (Personal Narratives Group, 1989) of Holly's narratives, I must be careful to not translate and categorize her story according to the genre of male selfhood. Therefore, a major point of interpretation is that in Holly's story, resistance has a great symbolic value.

> The rebel stereotype recurrent in many women's autobiographies would not aim to describe actual behavior, but would serve a markedly allegorical role. It could be the means of expressing problems of identity in the context of a social order oppressive of women, but also of transmitting awareness of oppression and lack of integration, and hence of directing oneself to current and future change. (Personal Narratives Group, 1989, p. 191)

As a high-achieving student, Holly was disquieted by her own intelligence. In Fordham's (1996) illuminating study of high-achieving African-American she notes, "high-achieving students' psyches are infested with apprehension and uncertainty, with fear and trepidation…" (p. 327). Further,

> [T]he high-achieving students find that commitment to the achievement ideology is contested, opposed, and frequently thwarted by the limitations endemic to membership in the…[Other] community. Resistance thus becomes the high-

> achieving students' method of overcoming the barriers that are externally and internally imposed. (Fordham, 1996, p. 248)

Holly's method and manner of resisting throughout her life are acts symbolic of a growing and developing awareness of her self as a subjective being. Holly's self discovery and self realization are unexpected outcomes of embracing the notion of a subjective (verses objective) identity.

Throughout her early childhood, the high value Holly placed on mechanical knowledge was uncontested. The discourses that directed and influenced her were underscored by Western objectivism. As a student (both early childhood as well as in college) Holly agrees that she was what Belenky, Clinchy, Goldberger, and Trule (1986) classified as a "received knower." In this capacity, "women who rely on received knowledge think of words as *central* to the knowing process" (Belenky et al., 1986, p. 36). For those who are received knowers, listening becomes a very active and demanding process.

> The ideas and ideals that these women hear in the words of others are concrete and dualistic. Things are right or wrong, true or false, good or bad, black or white. They assume that there is only one right answer to each question, and that all other answers and all contrary views are automatically wrong. (Belenky et al., 1986, p. 37)

Received knowers believe that Truth comes from Others. In turn, the self voices of received knowers are squelched in order that Others may be heard. Holly was taught to be a receiver of knowledge. Her parents instilled in her concepts of good and bad, right and wrong, ways to be and ways not to be.

> The fear of getting in trouble was huge…huge. I mean really. You just didn't talk in class and you didn't do things that you knew you were going to get in trouble for. You just didn't do it! I never got in trouble. We were always made to…expected to…behave in public. I mean we were taught early that when Mom and Dad were talking you didn't talk…and so on. So I think I was more reserved. I was more content to do my work and read my books and move on.

In the knowledge receiver mode, Holly was disempowered to make decisions. The voice of Other was dominant.

> Although most women find the powers of their voice and mind most readily in relationships with friends, those who think that they *receive* all knowledge are more apt to think of authorities, not friends, as sources of truth. They equate receiving, retaining, and returning the words of authorities with learning—at least with the kind of learning they associate with school. (Belenky et al., 1986, p. 39).

Since Others knew best, Holly was predisposed to listening to Them. Their direction was for her to adhere to a Master Text they had written for emancipated intelligent women. However Holly soon found that there were no guidelines, there was no path to follow, and there were no prototypes for success, that she could personally identify with.

> And you know, we've talked before, I sometimes think that it's easier on people who have very few interests and maybe average intelligence because they don't have all the choices. You know? "I love working on cars, I'm going to be a mechanic." Good, we need good mechanics. But they don't have the, "Should I go into music? Should I go into computers? You know, I really like to work with

> kids, should I do something with kids? You know, I can handle science, should I do that?" All the choices we had.

Through influences of Othering, intelligent young women are deceived into believing that, in their Specialness, decisions are easier to make. The Master Text for intelligent women is to relegate them to the margin requiring them to make isolated decisions. "Smart" girls are told, if they could just listen to Authority, that they hold the keys to their own futures. Unfortunately, these marginalized individuals often do not have access to the locks that their keys could open. Hence, doors continue to be bolted shut with different combination devices.

Holly, as a receiver of knowledge, was a very bright and promising student. She always received good grades; her test scores were high; she did not contest information given to her.

> These women either "get" an idea right away or they do not get it at all. They don't really try to *understand* the idea. They have no notion, really, of understanding as a process taking place over time and demanding the exercise of reason. They do not evaluate the idea. They collect facts but do not develop opinions. Facts are true; opinions don't count. (Belenky et al., 1986, p. 42)

As Holly says,

> I don't know why I didn't go into math, I think I probably should have…I didn't have to work, I wasn't challenged! There were no such things as independent study, or advanced classes, or honors classes or anything like that. I mean I saw the material once, and I knew it. I didn't have to work at it. So I wasn't really

> challenged. I could fill out worksheets; I could take tests—forever! I liked that! Can I make money doing this?

Holly felt confident about her ability to absorb, store, and regurgitate Truths received from Others. Gornick (1983) helps us to more closely identify with Holly when she was a student. In Gornick's descriptions of women in science she portrayed a bright student, similar to Holly, named Veronica Satino:

> Veronica was energetic, pretty, and smart. She enjoyed solving the problems in math, and the theorems in physics, partly because her facility was so obvious, but mainly because it made her special (not special-freakish but special-privileged), gave her an edge (none of the other girls was good at science), and extra excitement that increased her confidence, made her secretly arrogant. (Gornick, 1983, p. 127).

Likewise, Holly's secret arrogance was that she believed she was on the "right" path because she could well do the work Others dictated. Holly believed that through her outstanding academic performance she more closely aligned her Self with the expectation of Authority.

As a student, Holly's attributes are typical of received knowers. "She 'learns' the material; that is, she stores a copy of it, first in her notes and then in her head. She does not transform the material; she files it 'as is'" (Belenky et al., 1986, p. 42). Holly perceived herself as having, and Others perceived that she had, "the capacity to become [a] richly endowed repositor[y] of information" (Belenky et al., 1986, p. 43). Others classified Holly as being smart.

However, not all classes were easy for Holly. Throughout her educational career, those classes, which required her to forego mechanical knowledge, and develop an "inner" or personal knowledge, were foreign and difficult. Holly laughed:

> [W]hen I was in 9th grade I quit taking art because it was ruining my grade point. Everybody else would take art…I couldn't because I would get less than "A"s in art. So I never took those classes…you know the ones that everyone else took to pad their grade points. I never took those.

Holly avoided "artsy" classes. Holly willingly reproduced mechanical material on demand, as on an exam. However, she felt betrayed if the teacher asked her to "apply" the material or to produce meaningful materials on her own (Belenky et al., 1986). Holly thrived in classes that did not require inner reflection or a relational inquiry.

For those in the received knowers mode, incompliance to perfection of knowledge spells disaster. Being able to "sluff off" and be "normal" is impossible. "I could 'smoke them' in Around the World—you know the math game with flash cards? I could smoke everybody. However, if I didn't…if I missed *one*…or if I didn't do well, it was devastating." Received knowers have a skewed perspective of the importance of The right answer.

In the beginning, Holly's abilities as a received knower fed her intellectual vanity, gave her social cachet, and it enlarged her power within Authority. But that was in the beginning. As Holly's educational experiences progressed, she began to realize that the Other did not always dispense knowledge and truth that she could personally identify with and recognize as tailored for her Self:

> I mean I was very much on the college bound track. My courses were always taken with the thought of "What's going to help me when I get in to college?" But my guidance counselor was very un—well—useless. Just useless. I had no direction of possible careers. I had no careers. I had no direction of things you can do, nothing. I had no guidance. So it was kind of—I don't know how—I ended up in science. I suppose it was because I was at the top of the class and I did well in science, and so, it was just the natural thing that—you know—if you're smart you go into science. I don't know that it was my *favorite* thing. I liked school. That was my favorite thing…it was just *school*.

Still operating in the knowledge receiver mode, Holly was prone to listening to Others.

> If I would have said, "Well I'm going to be an elementary school teacher," people would have thought that's the most ridiculous thing ever! "You can't do that! You're too smart to do *that*!" What I really wanted to do was teach. "But you're too smart to do that. You need to be doing something *smart.*" You know?

Holly felt pressure from external forces driving her into a "smart" area. In her mind the only alternative—as there are only black and white decisions for knowledge receivers—was to make "intelligent" (e.g. science) decisions and choices.

> If one can see the self only as mirrored in the eyes of others, the urgency is great to live up to others' expectations, in the hope of preventing others from forming a dim view. Thus, women of received knowledge listen carefully and try hard to live up to the images that others have help up to them. They are especially at the mercy of authorities' judgments. If someone in a powerful position tells such a

> woman that she is wrong or bad or crazy, she believes it. (Belenky et al., 1986, pp. 48-49)

Authorities held considerable leverage over Holly. She looked to Their voice for direction and assistance. Holly's own voice had been subdued.

Holly felt compelled, as a freshman, to enter the university having immediately declared a major in both chemistry and biology.

> I declared a major. I think under pressure. I mean I think that I really didn't know what I wanted to do, but everybody said, "Oh you're so smart, you're so smart, you're so smart. You should go into science! You should be in science." And nobody else did well in science—and I did—so, "OK that's what I should be."

Here we see a contradiction. As Holly entered the university she had declared herself a chemistry and biology major; however, she was internally uncertain about the direction of study she should take. She recognized that external forces were driving her away from teaching elementary school and compelling her toward science. Even though Holly was being filtered into a science track we notice that she was uncertain about *what* in science she was going to do. Her phrase, "That's what I should *be* [italics added]" was significant because, even though it indicated she was compelled to *be* smart and to *be* in science, she was still unsure of everything else. The intellectualism that Holly had previously adhered to did not actually procure any great advantage for her as a freshman entering the university.

> I don't really love chemistry. I *really* had my heart toward teaching. But I was smart in school so I was supposed to do something "smart." I think English or

> composition would have been more interesting to teach but I had to teach a hard subject because I was smart.

Holly felt, as a woman, she was being held to higher standards of expectation due to her intellectual ability. Certain jobs—elementary school teacher, nurse, stay-at-home Mom—were classified as "out" because she was "too smart." She felt estranged from the choices others were allowed to make.

> "Set your goals high." I think everybody probably thought that I would go to medical school. There were just two little problems with that. Number one, I did not have the drive that I knew it would take, and I knew that I wanted family and free time and have other interests, and so there was no way I was going to have a job that was 24 hours a day. There was just no way. And also I can't stand the sight of blood. Just a little problem. Just a tiny weenie little problem.

Holly simultaneously resisted and submitted to external pressures involving her intelligence. Resistance is seen in her refusal to go into the field of medicine; her submission is seen in that she allowed herself to be dissuaded from areas she personally found interesting. This was an immense personal struggle for Holly.

During Holly's junior university year she felt an increasing trepidation regarding her whole educational experience. Clearly she had been a good student. Certainly she had taken all the "hard" classes. Obviously she had made "intelligent" choices. Unfortunately, Holly did not have the same sure sense for what a degree in chemistry and biology would mean for her as an individual.

> And I was a year away from graduating and had absolutely positively no idea what I was going to do—none whatsoever. And the classes that I had taken that

> year were not enjoyable. They were not things that I liked. You know, I wasn't taking organic [chemistry], I wasn't taking…and I think I just really got scared.

The dawn of Holly's resistance was birthed in the contradiction she felt between what Others dictated as Truth and what she was internally compelled to do. She still, however, did not recognize that she was her own source of knowledge. She perceived that, although she had followed the advise of "those who knew" by heading down a science oriented track, this track seemed to be a personal dead-end. She saw neither opportunity nor option available that would integrate her "inner voice" (Belenky et al., 1986) with the voice of Other.

> You know, I told myself, "I hate this. I can't work in the lab." And about the only thing that was available was working in the lab. And I just couldn't see the enjoyment in that. And there was still the…you know nobody told me, "Why don't you go to grad school, get your graduate degree and then teach at the college level?" Nobody ever said that. And so *teaching* was high school—and I'm thinking, "I don't want to teach in a high school," because of the [O]ther things that, "You're too smart to be a high school teacher."

Without viable alternatives, Holly resisted subjecting herself to Others' socially unacceptable career choices. However, Holly's collegiate and intellectual experiences had neither helped her to establish self-confidence nor a sense of personal identity. At this point, Holly's ways of knowing (as a knowledge receiver) conflicted with her "inner voice" (Belenky et al., 1986). This conflict put Holly on the verge of her great resistance.

About a week before Holly was to begin her senior university year, she decided to eliminate the university option completely. She dropped out. Holly had begun her personal resistance to Othering.

> So actually I got an award that year, I think it was a scholarship of some sort. I think it was a science scholarship to be used my senior year. And I never went back my senior year. In fact, at Main University, in the science building there is a plaque and my name is on it for receiving this award. But I never used it. I got scared and didn't go back. I couldn't go back. I couldn't do it.

The internal and external pressures to, "Make all the right decisions," and to "do everything perfectly" resulted in an academic "meltdown" for Holly. Her struggle to align personal knowledge with Others' expectation manifested itself in an abandonment of her esteemed educational career. Unconsciously Holly had begun to listen to her *self* as a knower of truth. Her resistance to Other-as-Authority had begun.

One of Patty Lather's (1991) graduate students (Kathy Kea) came up with a working definition of resistance that really seems to apply to Holly's life. She described resistance as "a word for the fear, dislike, hesitance most people have about turning their entire lives upside down and watching everything they have ever learned disintegrate into lies" (Lather, 1991, p. 76). In Holly's resistance to the Authoritive voice of Other, she forged a platform for a "different voice" (Gilligan, 1982), and her "inner voice" (Belenky et al., 1986), to be heard.

The crux of Holly's resistance, then, rests in her embracing subjective knowledge opposed to objective knowledge. It is vital that we recognize the significance of her resistance.

> Resistance is an important concept in looking at the lives of girls and women in schools, because it highlights their ability as human agents to make meaning and to act in social situations as well as to be acted upon. (Weiler, 1988, p. 48)

Prior to her resistance, Holly adhered to the Law of Logic as her sole means toward understanding truth and knowledge. Suddenly she begun to unravel discrepancies between the mechanical objective knowledge she had attained (while she was primarily a knowledge receiver) and the personal subjective knowledge she had stifled.

Outlining the disparity within objectivism, Goldberger, Tarule, Clinchy, & Belenky (1996) summarize Bernstein (1983), Kegan (1982), and Mahoney (1991):

> This is the assumption that lies at the heart of objectivism, a tradition that still dominates contemporary worldviews. In that tradition, truth and reality are singular, stable, and external to the person. Such a view essentially denies plurality, perspective, diversity, change, and the private realm—rendering meaningless any discussion of multiple, personal, or dynamic realities. The roots of objectivism lie in the misguided attempt to separate the personal knower from the process of knowing. (pp. 128-129).

Previously, Holly had been indoctrinated to believe that rational Truth contained in Others' objectivism was the only valid source of knowing.

> As appealing as it may be to some to carry out this Cartesian division of the world into discrete and knowable parts, the cost is high. It is devastating for those whose experience, history, and perceptions—whose truths—are obliterated. (Personal Narratives Group, 1989, p. 262)

Holly resisted this obliteration. For her, it was a process of disempowering objectivism and empowering subjectivism. When she "bucked the system," and temporarily abandoned her university education, she resisted the Authority voice of Other (as when she was a knowledge receiver) and moved toward hearing and receiving her nonunitary subjectivities as self authority.

After Holly dropped out of the university she continued the search for her own direction. Although her ears were unaccustomed to hearing her own voice, making the path difficult to follow, Holly eventually completed graduate work in chemistry and became a community college instructor.

Holly no longer exists solely as a knowledge receiver. Through her resistance, she learned the importance and value of questioning Others' authority.

> When women accept the responsibility for evaluating and continually reevaluating their assumptions about knowledge, the attention and respect that they might once have awarded to the expert is transformed. They appreciate expertise but back away from designating anyone an "expert" without qualifying themselves. An evaluation of experts is not only possible but is an important responsibility that they assume. For most constructivists, true experts must reveal an appreciation for complexity and a sense of humility about their knowledge. (Belenky et al., 1986, p. 139)

Holly is growing to operate under a more complex perspective. Statements she has made like, "I might get a Master's degree in mathematics," or, "I really value the time I have with the women who have retired from teaching," or (as an instructor), "I don't have to teach the same way I was taught," or, "I like to think about what I can become after I

retire" are all reflections of a woman who has successfully resisted the dominant discourse and "has begun to see her own thoughts orchestrating the changes that govern her life" (Belenky et al., 1986, p. 50). Through the difficult act of developing listening skills sensitive to her own voice, Holly is becoming clear and confidant to move in her own life.

Nonunitary Subjectivities and Holly

Holly's act of becoming a teacher as a profession is concomitant to her understanding different ways of knowing. Her nonunitary subjectivities are nested within her emerging development of understanding and knowing. This was her resistance to the dominant discourse.

It is through Holly's nonunitary connotation associated with her image of "teacher" that we come to develop a sense toward her subjectivities. As a child, Holly understood teaching to be a task "below" her intellectual and personal capabilities. Initially she rejected the possibility of teaching because the Authority voice, to which she so strictly adhered, directed her in (an)Other way. Ironically, it is *through* the act of teaching that Holly began to embrace her emancipated "different voice" (Gilligan, 1982).

> For the received knowers, being thrust into roles of responsibility for others helps erode the belief that they are dependent on "them" for "truth." For these women it is the act of giving rather than receiving that leads them to a greater sense of their capacity for knowing and loving. (Belenky et al., 1986, p. 47)

As an instructor of chemistry, Holly has had the experience of empowering her students to learn the beauty, and simplicity, of chemistry. As she has helped them she, in turn, has been strengthened. She has learned, through listening and caring, through empathy and

understanding, and through the act of teaching, to empower others—as well as her self. She continues her resistance to Other by teaching in a manner that demystifies the intellectual elitism associated with chemistry.

> Women typically approach adulthood with the understanding that the care and empowerment of others is central to their life's work. Through listening and responding, they draw out the voices and minds of those they help to raise up. In the process, they often come to hear, value, and strengthen their own voices and minds as well. (Belenky et al., 1986, p. 48)

A necessary element, then, essential for Holly to resist Othering, was the process of her own consciousness raising. Through her role as an instructor, Holly's understanding of Self has developed as a nexus to interchanges with other individuals.

Prior to Holly's liberation from being strictly a knowledge receiver, she struggled under the powerful Other to conform within societal expectations. She did not understand that, in this capacity, the dominant discourse was writing her life to the periphery. The conflict and tension she felt was her inner self-as-knower struggling to emerge. "[W]omen struggle to describe experiences that point to the *process* of being a knowing 'I' who changes over time and with context" (Goldberger et al., 1996, p. 92). Rather than strict definition, and binary opposition, this emerging understanding of subjectivities is, "an ongoing process in which 'I' creates self from moment to moment within the context of internalized and situational power relations. (Goldberger et al., 1996, p. 92). This description seems fitting for Holly as we interpret her nonunitary subjectivities through the underpinning of her resistance to her self as a knowledge receiver to her self as a producer of knowledge.

As I interpret Holly's nonunitary subjectivities, intermingled within her understandings of teaching, I am reminded of Heilbrun's (1988) quote from Nina Auerbach (1982).

> Whether deliberately, unconsciously, or accidentally, she seems to have composed her own life so that it's fitful, rudderless, and self-doubting first half was alchemized into gold when the austere bluestocking became the fallen woman. (Heilbrun, 1988, p. 48)

Clearly, Holly's educational experiences (during her "first half") were "fitful, rudderless" and full of "self-doubt." But were these experiences "alchemized into gold" (transformed into something of greater value) "when the austere bluestocking" (when the stern, superficially important, aristocrat) "became the fallen woman" (was fatefully symbolized as the Other woman)? Rather than interpreting that Holly has *succumbed,* and by fate was Othered to women's traditional narrative plot for women—becoming a teacher—I suggest that we interpret this act as a symbol of her embracement of self definition within her nonunitary subjectivities. This evolution of our understandings into Holly's nonunitary subjectivities "resists essentializing individuals by naming a particular immobile identity" (Bloom, 1998, p. 6). We have, thereby, transformed Holly's life "from a conventional to an eccentric story" (Heilbrun, 1988, p. 48).

Chapter 6

Participant Narratives: Anna's Story

This chapter examines the last respondent of this study. In chapter 6 we will look into the narratives and experiences of Anna. At the time of these interviews, Anna had already completed a Master's degree in physics and she was working toward a PhD in Education. Anna is married; she has four children. Anna had been teaching physics full time at a community college for three years when I interviewed her. Toward the end of this chapter I will examine Anna and nonunitary subjectivity.

Anna

Many articles, books, and publications indoctrinate bright young women into believing that there exists an unproblematic positivistic postulate of hard-line objectivity within science. Students are enticed by promises. Who should study science? "Especially if you are a female or a member of a minority group, you are likely to be heavily recruited and enthusiastically welcomed if you major in science" (Tobias and Tomizuka, 1992, pp. 18-19). Also, who is considered a "science type"?

> Are you a nonconformist who can't imagine yourself getting suited or dressed up every morning? Science (except in certain industrial labs and at formal gatherings) is as fashion-blind as it should be color- and gender-blind and is tolerant of all but the most bizarre personal styles. (Tobias and Tomizuka, 1992, p. 19)

In an attempt to recruit promising students, intriguing questions (with varying options) are posed: "Are you happiest working alone? Do you work well with other people? Do

you like foreign languages? Do you like travel? Are you a nonconformist?" (Tobias and Tomizuka, 1992, p. 19) Texts like this implore nonmajority nonconformist persons to consider a "promising" career in science. Further, students are led to believe that "science" is realized through a lifetime pursuit of personally satisfying modes of self-expression:

> How would you like to make a living doing what you enjoy? The true comparison is not between science and business; it is between science and the arts. For in their own way, scientists are artists. For many people, the appeal of lucrative occupations is that one can afford to retire early. The appeal of science and the arts is that you won't want to! (Tobias and Tomizuka, 1992, p. 20)

Here, science has a luring facade promising a warm enriching milieu. In texts such as this "science" is generally portrayed as sympathetic, welcoming, and acceptant toward individual differences. It is portrayed as an alluring, tolerant, and convivial environment. Science is depicted as a discipline that encourages and fertilizes promising young minds. Without critical inspection, the subterfuge promoting intelligent young women into science can be persuasive.

On the other hand, young students are also taught to understand that, as students of science, they must assimilate themselves into the mainstream. They are encouraged to pick up "different" language skills: the language of Science. These students are told that it is insufficient to merely memorize vocabulary; rather, the emphasis is for them to "learn science" (Tobias and Tomizuka, 1992).

> So however skilled you are at your own language, English, you are going to have to learn additional and quite different ways of communicating in science. The

> good news is that once you master a term in science, there's little room for error. (Tobias and Tomizuka, 1992, p. 24)

For nonmajority nontraditional students, assimilation through skillful employment of Western Science's mandated language does not seem to be an excessive price. Educational careers in science, therefore, are projected to require that students should be similar albeit different.

Clearly, women studying *within* science, in sharp contrast to these warm and welcoming messages, continue to endure harsh realities. There is a surreptitious facade, which masks underlying obstacles and barriers, primed for nonmajority nontraditional students (e.g., women) entering science. According to Heilbrun's (1988) perceptive observation, "secrecy is power" (p. 116). Keeping secret underlying barriers restricting women's participation within science assists power structures to dominate. "The conventionalist fails to grasp that modern science has been constructed by and within power relations in society, not apart from them" (Harding, 1991, p. 81). Issues of power engross Science.

Part of Science's power lies in furtive prolongation of the Science mystique. In their in-depth study of factors effecting women's underrepresentation in science, Eisenhart and Finkel (1998) notice a prevalent pattern. "Regardless of how high status is constructed (i.e., culturally defined), women (as a group) never seem able to measure up" (p. 34). Further, physics as a specific discipline within science, seems to be the most impervious to nonmajority nontraditional students. In fact, "men of color and all women are underrepresented in all the sciences, but the physics community is one of the most homogeneous in science" (Whitten and Burciaga, 2000, p. 213). Eisenhart and Finkel

(1998) incorporate Traweek's (1988) findings to establish a specific hierarchy of power within science:

> Among the physicists, theoretical physicists ranked at the top of the status hierarchy, followed by experimentalists. Similarly, physics as a discipline ranks above all others, followed in order by chemistry, engineering, biology, the social sciences, and finally the humanities (Traweek 1988). By these criteria of intelligence and reasoning, theoretical physics deserves the highest status because it is the most demanding. The humanities, in contrast, deserve to be at the bottom, because they demand the least. Also, in terms of this logic, women are not expected to make good physicists (Traweek 1988). In general, as one descends this status hierarchy, the percentages of women (compared to men), which are quite small at the top, become much larger. (Eisenhart and Finkel, 1998, p. 34)

Women are consistently underrepresented in science's high-status categories and throughout all stratums of science.

What accounts for this chilly environment? Why do women continue to be further marginalized in general by science, and specifically by physics? One explanation, based on the historical perception of science's objectivity, is offered by the Personal Narratives Group (1989):

> Far from encouraging our ability to think creatively about discovering the truths in personal narratives, our academic disciplines have more often discouraged us from taking people's life stories seriously. Disciplines have mainly done this by elevating some kinds of truth—the kinds that conform to establish criteria of

> validity—over others. Generalizations based on these elevated Truths become norms which are rarely challenged for their failure to consider or explain exceptions. This elevation and generalization serve to control: control data, control irregularities of human experiences, and, ultimately, control what constitutes knowledge. (p. 262)

Power structures continue to adhere to blatant acceptance of Science as Truth.

Harding (1991), however, questions the purported objectivity of science. She refutes the claim of value-free, impartial, dispassionate scientific research:

> If the community of "qualified" researchers and critics systematically excludes, for example, all African Americans and women of all races, and if the larger culture is stratified by race and gender and lacks powerful critiques of this stratification, it is not plausible to imagine that racist and sexist interests and values would be identified within a community of scientists composed entirely of people who benefit—intentionally or not—from institutional racism and sexism. (p. 143)

The precedent for participation within Science is through a patriarchal structure.[1] Truly, the patriarchal edifice of Science is maintained and due "in large part to the 'leaky pipeline'; women opt out of physics at every step along the way" (Whitten and Burciaga, 2000, p. 213). Gibbons' (1992) quote of Margret S. Klein, the former director of women's programs at the National Science Foundation, is found in Pattatucci (1998):

> Sex differences in rank and tenure status continue to exist in a major way, and the recent data do not show a significant improvement… You would think there was something mystical about the figure for the proportion of women at full professor,

> because it just doesn't change. It just sits there stagnating—almost independent of the changing pool of female Ph.D.-level scientists…. The basic obstacle is simply the old boy network, which is still very much in place….There are lots of hard-charging women out there, so the only reason I can see why women aren't making it to the top is that men feel comfortable working with men. (p. 203)

This structure systematically excludes, and marginalizes, women from its scientific ranks. The result is "gender apartheid" (Pattatucci, 1998) in science.

Summarizing Eveline (1994) and Mackinnon (1998), Benckert and Staberg (2000) raise questions concerning the debate relating similarities and differences of women and men as well as the conditions in which they do their professional work in science:

> In this discourse, male is normative. Questions are raised about women's similarity to or difference from men rather than the other way around. Rarely is the question asked, "Are men similar to or different from women?" *Woman* becomes "the other," the stranger, someone not like the normative being—man. Feminist suggestions that we should emphasize male advantage rather than focusing on female disadvantage avoid centering man as the norm (Eveline 1994; Mackinnon, 1998). (Benckert and Staberg, 2000, p. 86)

Under a postmodern feminist inquiry, then, gender-based exclusion from science is an urgent problem to be addressed. "Gender matters to…women scientists, independent of their attitude toward gender or feminist questions, both because they work in a male-dominated culture and because of this culture's symbolic value in society" (Benckert and Staberg, 2000, p. 99). Further, feminism "assumes a shared experience of all women by

virtue of their gender and regards gender-based inequalities in patriarchal society as problems to be eradicated" (Goldberger, Tarule, Clinchy, and Belenky, 1996, p. 187). Overall my goal in presenting this respondent's narrative is to lend validation to her (Anna's) experiences and to "interrupt patriarchy" (Lewis, 1993).

But how do we specifically structure our inquiry into Anna's understandings of gender related patriarchal hegemony within physics? Do we focus on gendered differences or do we focus on gendered similarity within the physics' patriarchy? We must heed Keller's (1997) advice, as quoted in Benckert and Staberg (2000), "We have learned to spurn facile assumptions of commonality, we need…also to spurn facile assumptions of opposition" (p. 99). Therefore, our exploration into Anna's narratives will reject a simplistic overview of her experiences. They will not be superficially interpreted as either one or the other, similar or different, from Others in the scientific community. Listening to Kimball's (1995) plea for "double vision," my exploration into Anna's personal narratives will be grounded through both similarity and difference.

Clearly, to explore Anna's gendered experiences within physics in terms of her differences to the Other is inadequate. Singularly focusing on gender *differences* lacks explanatory power. (It also undermines the dualism encouraged by postmodern theory!)

> The pattern of women's underrepresentation in elite science or engineering cannot be adequately explained by theories that depend on differences in biological characteristics, stubborn gender-role stereotypes, or recurring socialization patterns. (Eisenhart and Finkel, 1998, p. 36)

Rather, a more encompassing understanding can be established when we listen to Anna, as a woman, caught in the maelstrom of negotiating both differences and similarities

within the elite science of physics. To accomplish this end, I propose an amendment to a poem cited by Susan Chase (1995). The beginning of this poem, written by Pat Parker (1990), captures the struggle between friends when discussing topics of racial differences:

The first thing you do is to forget that I'm Black.

Second, you must never forget that I'm Black.

Parker's original intent was in reference to friendships. However, I have come to interpret that, for Anna, an adaptation and transformation of this verse will help us to envelop a better understanding of Anna's dual identity struggle of being a woman and being in physics:

The first thing you do is to forget that I'm a Woman.

Second, you must never forget that I'm a Woman.

In this light, for us to "forget that I'm a Woman" is for us to understand Anna's oppression through her similarities to Other. Likewise, for us to "never forget that I'm a Woman" is for us to understand Anna's oppression through her differences to Other. This will be an operative tool as I interpret Anna's narratives. Benckert and Staberg (2000) warn us of the "double bind" we will find ourselves. They inform us that both denying as well as claiming difference can be used to serve the gender hierarchy.

> If women argue that they are the same as men with the same conditions and should not have any special treatment, nothing in the hierarchy will change, or it will change as slowly as it always has, and the system will not be questioned. If, on the other hand, women bring out the differences, concerning family obligations or attitudes toward the male culture, the male norm will still not disappear and the

> women will risk being devalued and for this reason kept out of power. (Benckert and Staberg, 2000, p. 99)

This caution must not fall on deaf ears. However, my motivations remain in tact because thinking from Anna's life can provide crucial resources for the reinvention of physics for the many to replace sciences that are often only for the elite few.

> Without such new sciences, privileged groups remain deeply ignorant of important regularities and underlying causal tendencies in nature and social relations, and of their own location in the social and natural world. Without such sciences, the majority of the world's peoples remain deprived of knowledge that could enable them to gain democratic control over the conditions of their lives. (Harding, 1991, p. 312)

To understand both the similarities and differences of Anna to Others in physics we will begin by examining her experiences within educational institutions.

Schools play a major role in shaping the experiences of women within science. Undergraduate schools establish precedence for norms and trends seminal women's delineation within science.

> [T]he subsequent entry of women into more highly male-dominated science professions is more strongly related to the kind of undergraduate institution they attend and their undergraduate experiences than is true for their peers entering non-science professions where the majority of the distinctive measures having significant total effects come from outside the educational institution. (Kelly and Slaughter, 1991, p. 216)

Schools have not, however, developed and encouraged "uses of science and scientist identities that contribute to a substantive democracy and broad participation in it" (Eisenhart and Finkel, 1998, p. 247). Caplan (1993) summarizes results found by Cohen and Gutek (1991): "We have to recognize that, according to the most recent research, the environment in the majority of colleges and universities tends to be more welcoming and comfortable for males than for females" (Caplan, 1993, p. 29).

Exploring women's experiences in science's gender-unfriendly environment will help us to understand how they negotiate, navigate, and succeed as a peripheralized group. "Women's experiences in schools offer examples of how women are marginalized, positioned, and contained in powerless and supportive positions" (Martel and Peterat, 1994, p. 152). Therefore, to explore Anna's experiences in schools will help us to understand the ways in which educational institutions have served as a foundation of the patriarchal society. Anna's identities, and nonunitary subjectivities, are rooted in her gendered experiences as a student of physics and subsequently as an instructor of physics.

Anna is a white woman in her late thirties who currently teaches physics as a full time faculty member at a southern community college. She has taught at the community college level for three years. Prior to that, she taught high school physics for five years. Anna graduated from Central University with a master's degree in High Energy Physics as well as a master's degree in Mathematics. While attending Central University, Anna was never a graduate *research* assistant; rather, she was only allowed to be a graduate *teaching* assistant. Anna has always been a very intelligent student, in fact while in

graduate school she attests to have had one of the highest grade point averages of the U.S. born students in her class.

It is through our mutual graduate masters' degrees at Central University that I have come to know Anna. Although we did not graduate together, we certainly knew of each other. The uncommonness of being a U.S. white woman studying in the male dominated areas of physics and mathematics immediately drew us together. Although we have moved apart since graduate school, it was through this series of interviews that Anna discovered critical insight to her gendered graduate experiences in the field of physics.

Anna and I have conducted interviews by many different means and at several different sites. We conducted interviews using the traditional technique involving a tape recorder and an isolated interview location. On the other hand, we also conducted interviews over the telephone and through electronic messaging. Further we conducted interviews at the high school where she used to teach, at the North Campus of Central College, and in each other's homes. Probably the interview we enjoyed most was the time we each "abandoned" our families and drove to a motel halfway between our homes to spend the weekend. Although not a lot of productive interviewing was accomplished that heavenly weekend, we certainly enjoyed our time together in the name of research!

Anna has fought patriarchal domination and hegemony throughout her collegiate career and working experiences. These issues have completely colored her view of the world, her view of Self, and her view of the future. Anna was quite verbal about the anxieties, frustrations, and stress that she encountered relating to gender bias. I believe that through this verbalization she was allowed to release some of the emotional pain and,

simultaneously, use it as a tool by which to grow. For Anna, verbalization was a means of realization that allowed her to recapture pieces of her Self.

Some of Anna's early experiences in physics can be interpreted through her similarities to Other. In this, many of Anna's experiences of marginalization within science can be seen in her capacity to function as a "nonwoman." For example, I have come to believe that Anna decided to pursue an educational career in physics for many of the same reasons as Kottler (1997):

> Education was my salvation: If only I could get some higher degrees, I could somehow validate myself. Certainly, I had little chance to distinguish myself as an athlete or as a member of the most popular groups. I was an outcast, a loner who longed to be admired for something that separated me from the rest. It was not until well into my college years that I discovered that by achieving academically I could finally win the approval that I so desperately craved. (Kotter, 1997, p. 12)

Anna excelled in the mechanics of solving difficult problems of physics. Her ability to solve problems, and understand complex systems gave her the confidence to continue her studies within this area. It was Anna's belief that her abilities in physics would somehow validate her as competent and proficient. She hoped her experiences in physics would set her apart—distinguish her—develop her as a nonmarginalized person. Answering why, as an undergraduate, she decided to major in physics, Anna offered this explanation:

> I have a bachelor's degree in physics because I didn't know what else to major in, and it [physics] was hard, so I did it and I was good at it! I don't know. I *don't* know. I've asked myself that same question. Why didn't I go into something I

> *liked*? Well, I liked French, but to me French was a side course—it wasn't worthy of your attention as a focus of your life. Math was too abstract—it didn't apply to the real world. I wasn't as good in math anyway. I liked anthropology but I always thought that it was a "soft" science—so it wasn't as good as a "hard" science. Physics is the hardest science and the most pure science. All these neat, cool, and beautiful things in its philosophy really appealed to my ego and my sense of that understanding, you know? I like to understand things. And that really appealed to me. It's also black and white. Physics is so black and white.

Generally, women attempt to belong to the "in" White Male System in order to acquire a sense of belonging and acceptance (Schaef, 1985). Clearly, physics is a male dominated system. Anna's interpretation that physics was dualistic, "black and white," is underscored by Goldberger, Tarule, Clinchy, and Belenky's (1996) conclusion pertaining to the fundamental patriarchal assumption of objectivisim. "The most basic illusion of Western white male epistemology: that reality is a rational order revealed by reason and public sensibility" (Goldberger et al., 1996, p. 128). Anna's preliminary participation in this system, then, exemplifies how her experiences can be interpreted as an assimilated (non)woman.

Next we find another demonstration of Anna's marginalization through experiences of similarity in her explanation of the rigors related to being a student of physics. The work associated with the science of physics is demanding. Physics students often complain that there is no time to take classes they "like", that the coursework of physics lacks relevance and applicability to "real world", and that these demanding classes are made harder than they need to be (Eisenhart and Finkel, 1998). Outlining a

study by Nespor (1994), Eisenhart and Finkel (1998) summarize how students studying physics organize time and space, connecting individuals to each other in relations of power:

> Nespor finds physics to be an especially "greedy" degree program (or "major"). It requires a precise sequence of increasingly advanced coursework, concentrates that coursework (and thus the students) in one building, demands significant academic work outside of class, permits only a narrow range of "good-student" identities, and focuses the course content on abstract, "mathematized," and invariant models that separate it from everyday referents. Thus the program channeled students into a tight spatial-temporal regime that demanded virtually all their time, separated them from other students and activities, reconstructed their social activity and talk, and headed them toward a single endpoint (identity): graduate work and a career in physics. (Eisenhart and Finkel, 1998, p. 52)

As a (non)woman student of physics, Anna anticipated and was familiar with its rigorous work. Like her male counterparts, she experienced frustration with aloof instructors. As with Other students of physics, Anna constantly had to prove her personal work had value in the face of detached instruction:

> I had Mr. Cadmium as an instructor in my calculus-based introductory physics course. I chose to do an independent study a year later with Mr. Cadmium, where I was trying to emulate the refraction around the rim of the moon. I used the laser beam and I did all this stuff, hooked it in the computer, learned about stepping motors, and all this stuff. He didn't help me even once. At that point, I had never done any experimentation at all, and I was supposed to write up all this stuff and

> program this Apple-II-something computer. I remember looking at him and talking to him about my grade at the end of the quarter. "I think you get a *C*," he said. I just looked at him, and I was almost in tears. I couldn't believe he said that to me. I said, "Why? Why do you think I need a *C*?"

Anna described how she attempted to explain and justify the quality of her work.

> And I said, "Why? Why do you think I need a *C*?" I said, "(A): I did this on my own. (B): I've written and I've kept a journal if you'd like to see it—here it is. (C): I've completed the goals of my projects—all these things." "Okay I'll give you a *B* then." Oh it just made me so mad.

The weak concession to her course grade was little consolation for Anna. Students of physics (male and female) are marginalized by instructors' disinterest and lack of empathy toward their educational experiences and progress. These students' shared experiences mutually isolate and exclude them from faculties of power.

A third illustration of Anna's marginalization from physics, in her experiences as a (non)woman, is through her parallel, or shared, encounters involving the qualifying examination for doctoral study in physics. Both emotionally and physically, the qualifying examination in physics is one of the most grueling and painful experiences for a graduate physics student. The "qualifier" is the exam where, upon successful completion, the student has proved worthiness to enter into the physics doctoral program. There are two components to this examination at Central University. The first component has a modern physics emphasis while the second component encompasses general physics. Students have to pass both components in order to be recognized as

having successfully completed the qualifier. Without this successful completion of the qualifier, students terminate graduate work in physics holding, at most, a master's degree.

Anna took the physics department's qualifying examination at Central University twice. The first time she took the exam she flunked the modern physics portion but passed the general physics portion. The second time taking the exam, she reversed the components she had originally passed and failed. Anna never completely passed the qualifier. To those who flunk the qualifier, a master's degree is little compensation. Internally Anna was devastated. "When I flunked the qualifier, I couldn't become a physicist." Anna felt pushed out of physics. The strong patriarchal power sphere of physics had been impenetrable to yet another student. Echoing Anna's sentiments, Franks (1998) described a similar debasing experience: "My advisor was immediately disappointed. In his world, a master's degree was a consolation prize for those unable to shoulder the rigors of PhD work" (Franks, 1998, p. 121). Heilbun (1988) helps to understand this "unnaming" as a professional physicist:

> [W]ith highly gifted women, as with men, the failure to lead the conventional life, to find the conventional way early, may signify more than having been dealt a poor hand of cards. It may well be the forming of a life in the service of a talent felt, but unrecognized and unnamed. This condition is marked by a profound sense of vocation, with no idea of what that vocation is, and by a strong sense of inadequacy and deprivation. (Heilbrun, 1988, pp. 52-53)

Students who flunk the qualifier are forced out of physics. "A feeling of hopelessness often accompanies the life of marginalized groups" (Martel and Peterat, 1994, p. 161). In this hopelessness, they are left with an internal sense of failure and dispossession. They

are offered no alternative but to be excluded and eradicated by physics' intellectually elite. These students have a hard time reconciling the internal inconsistencies they perceive. Specifically for Anna:

> I didn't have a very good opinion of myself. Think about it—my GPA was one of the highest GPA's of any of the American students there. I had a 3.5 GPA in *graduate physics*! You know? So why did I flunk the qualifier? There's something wrong with one of those things. Either my grades are not indicative, or the qualifier was not indicative of what they were teaching. That was hard. I really felt like a nothing after that qualifier thing. I was never given permission to be a physicist.

Cognitively, Anna knew she was barred from further graduate work in physics; emotionally she felt prohibited from participating within the power structures of physics. Anna's marginalization, as well as for others who flunked the qualifier, was complete.

Finally, Anna's experience as a (non)woman are similar to many who opt to teach.[2] In this capacity, instructors (male and female) are pawns to managerial structures of power. Anna's feels that schools (specifically high schools) are an avenue in which patriarchal domination is manifested in its ability to monopolize and control. Under this oppression, strong administrative powers are given license to manipulate and regulate. Beneath the camouflage of building classroom quality, public school administrators are given free reign to power. To the public at large, it is generally perceived that high school instructors are relatively autonomous. Here we have Anna's retort:

> One reason I'm dissatisfied with teaching is because it is not a respected position. And so my boss, and his boss, and all the bosses don't respect the teachers that

> work here. And they don't pay them what they're worth. They don't respect their time. They don't respect their opinions…. We're treated as infants almost. It's to the point where if we are given work time, instead of giving us the hour to do grades or something, they schedule a meeting because of their belief that when people have free time they just sit around and talk. So, hence, people are up until, like I was last night, 2:00 o'clock in the morning grading papers because there's no time in the day to do that kind of work.

With her school time completely monopolized, as a high school physics teacher, Anna was restricted to completing schoolwork during her "free" time. She resented the elements of control and domination restricting her experiences in this particular high school. Although she did not have experiences teaching in other public schools, Anna had a propensity to view the entire public school system as typical structures of patriarchal domination. Munro (1998) voices similar frustrations with school politics:

> Eventually, I felt alienated, frustrated and unwilling to compromise my values one more time. Although my work with students had been rewarding, the increased lack of autonomy, the devaluation of my work and the hierarchical nature of the schools made it difficult to maintain my level of commitment. (Munro, 1998, p. 22)

These narratives give insight into the *raison d'être* regarding the high exodus of qualified instructors from science instruction.

It has been established that Anna, in her experiences as a (non)woman, has been marginalized. She attempted to function and acclimatize her life, her experiences, and

her subjectivities into that of mainstream physics. We realize that her identity is socially constructed through influences of power. But is this understanding of similarity enough?

> The consciousness of the women who did find a place in science was often not feminist. Indeed, even a *woman's* consciousness could hardly be permitted if the fiction were to be maintained that a woman scientist must be a contradiction in terms. In order to succeed as scientists, these women usually had to force their lives as closely as possible into life cycles designed to accommodate the lives of men in patriarchal societies. Their possibilities for marriage and children were severely diminished in ways that never affected their brothers. (Harding, 1991, p. 23)

This brings us to the threshold, where recognizing and voicing the important *differences* in Anna's gendered experiences *as* a woman within physics must emerge.

> Unfortunately it is this very striving for "normality" that also handicaps our daughters and vests power with our sons. In a culture where the norm is inequality, injustice, and exploitation of the many by the few, the discourse of "normality" means that proposals for equality, justice, and freedom often appear at best as socially inappropriate, sometimes abnormal and often "hysterical." (Lewis, 1993, p. 91)

Women's lives are constructed in their ability to invisibly participate within patriarchal structures of power while simultaneously working to develop idiosyncratic identities that distinguish them. Lest we forget Anna as a Woman, we must investigate how her experiences are gendered and distinct from her male counterparts.

As a student studying within physics, Anna's gender fundamentally marked her for further marginalization. As an undergraduate student, Anna began to grasp that, as a woman, she would endure disparate experiences compared to Other students of physics. Further elaborating on her experiences in calculus-based introductory physics, Anna's anger was clear. After successfully arguing for an improved grade status, she noticed the instructor's gendered demeanor.

> And yet the boys and the men he was working with, you know, he would never even consider giving them B's! At the time I thought maybe I was just bad, I was a poor physicist, a poor student, or something. But I wasn't. It was the good-old-boy network at work. Guys would be in there goofing off, looking at all his toys and stuff. He could place me working with his daughters at preschool. He could place me at baby-sitting his kids, but he could not place me in physics. It didn't make sense in his brain.

Anna found that her undergraduate experiences with gender bias and marginalization were not isolated events. In graduate school, as a female student, Anna's marginalization persisted. She describes several examples how, as a woman, she was disparaged by sexist statements from her own professors:

> Remember [my major professor]? He said, "What we need in high energy physics is more dedicated single men." Okay? Okay? That lets me out doesn't it? Probably on all three strikes, according to [him]. Just those kinds of things over and over!

Anna's first and foremost "strike" was that she was the wrong gender. "Strike two" was that clearly she must not have been dedicated enough, since she had not passed the

qualifying examination for doctoral study in physics. In fact, after flunking the qualifier, one faculty member offered her his opinion. According to Anna, "[He] came up to me after I flunked the qualifier and said, 'Just take a couple years off. You know, women in physics just don't mature quite as fast as the men do.' He said that to me word-for-word!" Anna's third, and final, "strike" was that, although she was not dating at the time, it was assumed that Anna was preoccupied with a predominant goal to get married. Sexist statements such as these compounded Anna's despondency. Through gendered differences, Anna felt completely put out of the ballgame of physics.

After being terminated from further physics graduate work, Anna taught high school physics for six years. She abruptly quit teaching at that particular high school after her instructional contract expired. "And that's it. I got sick of [teaching high school physics]. I got treated like crap! I decided I didn't want to do this anymore…and quit." Anna felt certain her abilities would procure for her another teaching position at a near-by college or university. Anna was then hired to teach four recitation sections of second semester calculus based physics at Central University. However, the term of her employment was for only one semester. Adding a layer of complexity to the circumstances, Anna was due to have her second baby early in the next spring.

> Then in spring, when they didn't have anything for me, I kind of went begging for it. And [the physics department's hiring coordinator], (remember he was an instructor)—and there was a graduate student who dropped out—female! Who could have guessed? Surprise! Surprise! And he wrote me and said, "If you're not going to deliver your baby in spring, if you're due in summer, then you can

> have this job. But if you're due in spring you can't." I wrote back and said, "I'm sorry…that's illegal." And so they gave it to me begrudgingly.

Central University's physics department attempted to discriminate against Anna and disallow her a teaching position because of her pregnancy. Anna pressed for her legal right. She was asked to meet with the head of the physics department; she recalled the patronizing nature of the conversation:

> And [he] called me into his office and suggested that I get a nanny like his daughter did. And that that would be a better way for me to go about having a family if I wanted to have a family. How out of touch with the world can you be? He's the chair of the department! He called me in, and when we were discussing this he said, "Well I'm going to hire you for this, but I really suggest you get a nanny. That's what my daughter did." And I'm looking at him, thinking, "Do you realize the reason I need this job is because my husband is unemployed? You know? And I have a child on the way, and I have a child at home. There's no money for a nanny! This is our income! This stupid money that you care so much about, you know?" "Aarggh."

Since Anna "forced" her way into the department, her presence was less than welcomed. Clearly the physics patriarchal structure attempted to direct and control Anna under the guise of "fatherly advice."

> So then I felt like I was on borrowed time, anyway, you know? But I only missed two weeks [after having the baby]! I missed two recitations in each class, two labs in each class, in two sections. Big deal…you know? And this was something they weren't even going to hire me for. And the money lost?

> Everything was covered by their short-term leave policy…everything. But they were just typical men.

Women are often caught in the impasse between being a woman as mother, wife, caregiver and being a woman as scientist or worker. This dissimilarity distinguishes them from their male counterparts, further marginalizing them.

> A special problem that is brought up frequently is that women have difficulty combining work and child care, as the men still do not take the same responsibility as women….The women clearly position themselves as "others" in the science world when they look upon their lives as parents (Benckert and Staberg, 1998). As women with children, they have to struggle harder than male scientists, with or without children. As scientists, women are caught in a dilemma. The model for a scientist is a man, and as women they strive to be good scientists—that is, nonwomen—at the same time as they are very much aware of their womanhood. (Benckert and Staberg, 2000, pp. 92-93)

Social distinctions gendering women's responsibilities toward family weigh heavy on women who choose to participate in both science and family.

Reflecting on her overall experiences within physics, Anna scorns her distinctive gender marginalization. She believes her participation within physics was for naught. She deems her "mark" to be invisible.

> You still have the old farts that are still teaching the same classes the same way—still offering scholarships to the same men—their replacement counterparts, you know. You're never going to see [a male physics professor] take a girl under his

> wing and try to nurture that interest in physics and that curiosity, that drive to learn. You'll never see that. But he did that. He will do that again with boys.

Anna is a woman who, in areas other than physics, has found validation and support. However, she grieves the loss of her voice within Science. She continues to sense that her experiences with gender marginalization effect and haunt her daily routines.

> Even among women who feel they have found their voice, problems with voice abound. Some women told us, in anger and frustration, how frequently they felt unheard and unheeded—both at home and at work. In our society, which values the words of male authority, constructivist women are no more immune to the experience of feeling silenced than any other group of women. (Belenky, Clinchy, Goldberger, and Tarule, 1986, p. 146)

Silenced and marginalized, Anna has bitter feelings toward physics. Last year, we had an opportunity to meet in the city that is the home to Central University. Driving past the university, where we had met as graduate students, Anna cringed. Her face tightened and she gritted her teeth. I could sense her blood pressure rising. When I asked her what was wrong, she replied:

> I hate that place. I hate it. It's weird how those feelings started coming up. All these feelings start coming forth…like guilt…embarrassment… frustration…anger…and I don't even know where they come from. It's weird! Think back! Think what a hell that was! And we didn't even know. We didn't even have a clue as to how oppressive that atmosphere was. And I, you know, I think about all those things that they…how those people in power treated us. You know? I hate that place.

Vivid impressions linger in Anna's heart and mind. Whether we understand and interpret Anna's experiences in physics through her similarity (being a nonwoman) or through her dissimilarity (being a woman), one thing is clear: the far-reaching and enduring influence of physics' dominant patriarchal structure has had an immense effect on Anna's life.

Nonunitary Subjectivities and Anna

Anna's personal narrative provides us with a primary example of nonunitary subjectivity which allows us to further examine the critical roles that pivotal personal experiences play in the construction and alteration of subjectivity. Within Anna's educational and professional career we easily recognize that the moment she did not pass the graduate physics qualifying exam (the second time) was one such pivotal experience which truly fragmented her subjectivity. Through examination of this experience we can further understand the complexities of Anna's nonunitary identity.

In 1873, Martha Somerville wrote personal recollections about her mother Mary Somerville. In her writings Martha summarized accounts of her mother's life and reflected upon her mother as a mathematician, scientist, and woman. Within these excerpts we find thoughtful expressions which allude to defining the complexities of nonunitary subjectivity:

> It is not uncommon to see persons who hold in youth opinions in advance of the age in which they live, but who at a certain period seem to crystallize, and lose the faculty of comprehending and accepting new ideas and theories; thus remaining at last as far behind, as they were once in advance of public opinion. (Somerville, M. 1873)

We can use this statement to reveal Anna's alteration of subjectivities. In Anna's youth, when she entered graduate school, she was "advanced in the age" that she lived in that her goal was to become a physicist who was a woman. "I had this lofty idea of being a university professor, or whatever…then I flunked my qualifier so I couldn't become a physicist." When she did not pass the graduate school qualifying examinations we see a crystallizing moment which was transformational to her subjectivity. This moment caused her to doubt her personal ability, her life goals, and her own subjectivity as she was excommunicated from further entrance into the halls of science. In Anna's self opinion the results of those qualifying examinations indicated that she was not a physicist, not a researcher, and not an academician. Her goals of penetrating the non-margins of physics were completely crushed. In turn, Anna believed she had been relegated to an inferior realm of science; Anna turned to teaching physics at the high school level. Thus began a period within Anna's life experiences that she lost "the faculty of comprehending and accepting new ideas and theories; thus remaining at last as far behind, as *she* (sic.) once was in advance."

Upon arrival as a physics teacher at the high school, Anna was immediately conflicted between being employed and being hired at a position that she personally deemed lower than her self esteem. In her opinion, other teachers in the science department were not as well trained or as intelligent as she was. Anna questioned why she had to be there at all. Anna never wanted to teach high school physics but she could not fathom another professional avenue to explore. During this period of isolation and discontent, Anna perceived that she wasn't the educator she thought she could have become. "I don't have to think about physics anymore. But the thing is that I also don't

understand where students have as many troubles as I used to. I'm not as empathetic with the students as I used to be. I no longer understand what they don't understand." As to shrug off the responsibility she felt toward her students' understanding she said, "It's just that ideal of teaching and caring about your students, you can't maintain that kind of commitment. You can't maintain it…the boredom of repetition. Sometimes I just can't do it…teach this stuff again. Lack of respect is big...lack of control…lack of freedom. I don't even care how my students respond to me. But I wouldn't want to teach anything else because then I'd have to work too hard to relearn something that I don't care about." She did not perceive there to be any tangible future benefit for her to continue as a high school instructor. Plainly Anna's response is a complicated and layered statement which entirely signifies a copious splintering of subjectivities.

Anna received a 'Teacher of the Year' award from the High School she taught within two years of her hire. This recognition did not silence her internal discomfort and shortly thereafter she quit teaching physics at the high school level. "I decided I didn't want to do this anymore…and quit," she succinctly exclaimed. It was at this next juncture that Anna returned again to Central University in pursuit of a PhD in Education. When asked if she "valued" this PhD the same as she would have if it were in physics, Anna replied, "It's meaningless! I often think about that. But you know what? I'm outside of the realm of people who think that way, and so it doesn't matter any more." She goes on,

> …when I talk to my friends about my degree program I stutter…I stumble…I look down. 'I'm getting my PhD in Instructional Technology,' I tell them. Then I tell myself to be proud of this…I make my self be proud. I *never* say that I am

> getting my PhD in education…I always say Instructional Technology…but I don't feel that it's worth as much (as physics). And see…I guess I'm OK with that. If I were doing my research in, you know, the Babylonian knitting stitch, I would be working on it! I'd be digging and writing and looking…but I am creating a freakin' sound lab for my PhD! It doesn't interest me in the least! Can I change? It's too late for me to change…instructional technology is not interesting to me! That's why I'm in 28th grade.

Anna recognized that in order to receive some of the professional recognition and employment opportunities she craved she must complete a PhD program, albeit a program she did not personally value. Her decision to complete an "inferior" PhD program at Central University illustrates the nonunitary nature of Anna's personal subjectivities.

Chapter 7

Discussion, Implications, and Summary

"At the community college, women account for the majority of students and have parity in the faculty ranks, even at the full professor level. In 2003, full-time women faculty accounted for 49 percent of full-time community college faculty (Cataldi, Fahimi, and Bradburn, 2005) and in 2005-2006, 50.8 percent (West and Curtis, 2006). No other higher education institution has this high a percentage of full-time female faculty members."
B. K. Townsend, 2008, p. 11.

The completion of this project has provided a wealth of data and information along with several surprising but consistent themes among the respondents. In this chapter, I revisit the original research questions and discuss their outcomes in the context of the participants' stories. I offer a discussion of the limitations of this study and share my personal reflections on the research process. I provide recommendations based on the study's findings and suggestions for future research. Finally I share educational recommendations for practice within STEM fields and an overall summary of the project.

Research Questions and Findings

There were two encompassing research questions that guided this research study. The first research question asked how these women natural science community college faculty make meaning of their current academic and social experiences within their science based upon their postsecondary educational experiences. The second research question examined the role that community and personal support systems had on the decision making process for these women as they choose careers within STEM fields. The data gathered from this research project offered surprising and interesting findings for each of these research questions. Overall we are able to more clearly focus these findings and develop answers to the original research questions through an examination

of the themes which evolved within the respondents' narratives. In this section, I detail those findings.

Common Themes

Two themes common to each of these three respondents are identified in this study. The first theme examines how a woman community college natural science instructor makes meaning of her chosen profession based upon her postsecondary educational experiences. This theme investigates whether women natural science community college instructors self-define themselves as scientists, instructors, or both. The first common theme is named, "Issues of Identity: Are we scientists or *just* teachers?"

The second theme that emerged from this study examines issues of community and personal support systems for the three respondents as they developed within STEM fields. Within this theme the respondents identify the importance of strong community structure within their chosen field of study. The second common theme is named, "Issues of community: Where is the support for young women in college and for adult women teaching at the community college?"

Issues of identity: Are we scientists or *just* teachers?

How does one classify a woman community college natural science instructor's profession? Should community college instructors of chemistry, biology, or physics, be regarded as scientists? Or, on the other hand, when a scientific researcher quits working in the research field, and opts to teach at a community college, has she forsaken her identity as "scientist?" What is the definition of "scientist?" Are community college faculty relegated to be identified only as teachers and instructors? Issues involving

identity were disconcerting to the women in this study. Liza, Holly, and Anna deliberated over the issue of self-identity.

We will examine the narratives from the three women who participated in this research project, to develop a better understanding of their perceptions as to the issues surrounding their identities. The introduction lays the groundwork for a theoretical stance and builds the case for such issues to be discussed. Then, one by one, we will examine the signification this issue has had in the lives of Liza, Holly, and Anna. To begin with, Liza claimed she mistakenly referred to herself, in her role as a community college instructor, as "no longer a scientist." Later she recanted this claim and repositioned herself as having a scientist identity. Holly, on the other hand, affirmed that she was a teacher whose subject material happened to involve science. However, after careful consideration, she developed insight that her identity was exactly aligned within her own definition of "scientist." Lastly, Anna refused to associate her work as that of a scientist's. Based on her university experiences, she shuns any similarity between her identity as an instructor of physics and the identity she associates with physicists.

The traditional perception of what a scientist looks like is well known. The conventional characterization of today's scientist is a white man, somewhere between the ages of 30 and 90, generally having a long beard and other scraggly facial hair, who is incredibly intelligent, who carries 2 or 3 calculators (in case one breaks down) in multiple pockets, who wears pocket-liners to protect his shirt's chest pockets, who carries a ruler in one hand and a test-tube in the other, who wears a white lab coat while donning black horned-rimmed glasses on the end of his nose, who has an unkempt attire, and who is socially inept. Along with this image is the idea that scientists work in impressive and

expensive laboratories. He is busy with the work of science: theorizing, hypothesizing, and experimenting. His mission is to further the scientific boundaries of human understanding. This stereotypical quantifying of what it means to look and work like a scientist is very familiar. The women of this study do not physically resemble the traditional scientist's proverbial stereotype; also, their scientific work is accomplished at nontraditional locations. Conversely, the perception of the work accomplished by a traditional stereotypical scientist is identical to the realistic work accomplished by the women of this study.

The conventional perception associated with what a teacher looks like is quite simplistic. The traditional perception identifying a teacher is a white woman, calm in voice, gentle in spirit, ample in patience, and loving in nature. This meticulous woman is strict but yet giving, tough but yet tender, and her placid fortitude is directed unselfishly toward her students. This woman teaches in a pristine classroom filled with cheery wall hangings. The chairs in her classroom are neatly arranged with students sitting in organized predestined locations. Presumably after this composed woman teaches all day she enthusiastically hurries home to accommodate family and spouse, later to cheerfully attend to the responsibilities of her home. Although the women of this study are the correct gender in this stereotypical perspective, they claim very few of the other attributes described for themselves.

Community college faculties refer to themselves using a variety of descriptors. Some call themselves teachers. Others refer to themselves as instructors. Rarely do they name themselves as professors. Therefore, what distinguishes a teacher from an instructor or professor? According to Webster's Ninth New Collegiate Dictionary (1986)

a teacher is, "One that teaches; one whose occupation is to instruct" (p. 1210). While the definition of instructor is, "One that instructs: teacher; a college teacher below professorial rank" (p.627). Lastly the definition of professor is, "A faculty member of the highest academic rank at an institution of higher education; a teacher at a university, college, or sometimes secondary school" (p. 939). In this study, none of the women identify themselves as being professors. All of these respondents vacillated between referring to themselves as teachers and instructors. Within the definition of "instructor" we find a hierarchy for classifying those who teach at the community college: "below professorial rank." Does this imply that Liza's doctorate in biology is invalidated at the community college? How do we synthesize these definitions to describe the women of this study? Clearly the work of these women is to explain, demonstrate, experiment, lecture, train, coach, tutor, direct, teach and instruct. This is only a part of the complicated issue of identity for the women of this research project.

On the other hand, what is a "scientist?" According to Webster's (1986) a scientist is, "One learned in science and especially natural science: a scientific investigator" (p. 1051). The women of this study are all learned in the natural sciences. Liza has earned a Ph.D. in Biology; Holly has earned a Masters in Chemistry; and Anna has earned both a Masters in High Energy Physics and a Masters of School Mathematics. Therefore, these women have satisfied the requirements outlined in the first part of the definition of "scientist." The second part of the definition is what confounds the self-perceptions of the women in this study. What does it imply to be a "scientific investigator?" Apparently, it is someone who investigates science. Who does that? Is someone who teaches physics a "scientific investigator?" To investigate is to examine,

look at, explore, inspect, study, consider, probe and scrutinize. These synonyms are genuine descriptors of the work accomplished within the natural science classrooms these women conduct. Hence, Liza, Holly, and Anna should be able to identify themselves as scientists. Jaime Grinberg (1994) substantiates the idea that teaching is a form of scientific research. He claims "teachers have been neglected as generators of knowledge by academic research" (Grinberg, p. 127). Grinberg goes on to describe teachers' daily practices as a "certain type of unrecognized research" (Grinberg, p. 129). He claims that when teachers realize that they are able to produce meaningful research, they lend validation to their craft (Grinberg, p. 129). This is a solid theoretical stance behind embracing the identity of "scientist" for these community college instructors.

The question, "Am I a scientist?" inevitably arouse during the interview process for all three respondents. Two of the respondents had an immediate response that conflicted with the stance they later assumed. For example, to this question, Liza denied she was still a scientist. Later she reclaimed her position and proclaimed, "Yes," she was a scientist. To the same question Holly immediately answered "no" only later to reflect and ponder whether or not she was a scientist. Anna was the only respondent whose resolve did not waver during the interview process: she announced "no" and she did not change this stance.

Liza: Scientist or just teacher?

Within the first interview with Liza, issues involving her scientist identity immediately developed. In a conversation regarding the details of her background—where she lived, when she moved, how long she was in one place or another—Liza made a remarkable statement. In her description, of the reason why she chose to quit working

at an east coast research laboratory and move back to the central states to become employed as a community college instructor, Liza made a drastic comparison. She said, "I would be a much better scientist now, than I was then, because of my much broader background." Here Liza suggested she was no longer a scientist (in her role as a community college instructor). Her words were not present tense action words. She did not claim, "I am a much better scientist," rather, she predicted she would be a better scientist due to her experiences as an instructor. Liza suggested she no longer identified herself as a scientist.

Liza took professional leave from the North Campus, to attend a weeklong scientific conference in St. Louis, Missouri, fall 1999. Here she was confronted face-to-face with issues of identity.

> I went to small meetings before you know that. But St. Louis was the first scientific meeting for a long time…since I quit my science career. And I actually felt kind of out of place at first, because here it was on my nametag "Dr. Liza VanMaurren" but instead of "university" or "hospital" or "medical school," which all the other people came from, it was "North Central Campus of Central College." OK? So the question I received, not once a day but all the time was, "Well, community colleges don't have research do they?" Everybody was assuming that if you go to that scientific meeting you've got to be a scientist.

Here Liza was forced to examine whether or not she had surrendered her identity as a biological scientist through her role as a community college instructor. This issue was very threatening for Liza, as she interpreted "just teaching" to be a lower stratum of power.

During the conference, one of the presenters claimed to be unaware of documentation or evidence relating the effects of anticholinesterase to Alzheimer's patients. Liza's heart jumped because (thirteen years prior as a research scientist) she had performed trials of this nature. However, Liza was frozen in place. She could not raise her hand to dispute the presenter's claims.

> When I was still in science I would have immediately raised my hand. You know? And I would have informed the whole audience that, "yes this is published, yes there is evidence." I didn't have the guts. I did not have the guts to raise my hand and say it.

Liza's words reveal how she subconsciously viewed her identity while employed in the position of community college instructor. The phrase, "while I was still in science" implied she no longer believed she was in "hard science." Clearly she viewed her past position (while in research) as one that classified her as "scientist." When asked why she felt she could not raise her hand to challenge the presenter's claims, she said,

> I don't know. Because they were all physicians, they were all scientists and I am not. Or they are all researchers and I was not anymore. And my work was so old I mean that was published in 1986 I believe.

Here Liza suggested that she was no longer was a scientist because she was no longer employed as a researcher in an experimental laboratory. Her statements reflected that she questioned the value of her identity as a community college instructor. That day Liza herself began to realize a disjunction between what she thought and what she said.

When asked outright, “Are you a scientist?” Liza’s immediate reply was, “Yes.” She did not recognize the confliction in her statements. Wanting to clarify her position, a month later, I asked her to rethink these points. Here is a portion of our conversation:

Nancy: You said, “Since I quit my science career.”

Liza: I should not have said “science career.” I should have said “research career.” That’s the better word.

Nancy: OK, but now bottom line, Liza you teach science—are you a scientist?

Liza: Yes.

Nancy: Because?

Liza: Because I teach science! I mean, I should have said “research career.” I really should have said “research career.”

Nancy: Let me give you a little background. Anna and I have the same degrees however she does not consider herself to be a scientist.

Liza: Because she is not!

Nancy: Because?

Liza: You have to be what I just explained. You have to be—you have to have that drive to make it better. You know? If that drive is just to make science education better, that is still an achievement, it’s still achieving something in sciences. Now it happens to be science education and not research, and I really should have said “research career.” Because that’s why—you know I quit my research career, but I did not quit to be a scientist. No.

Nancy: I’m just clarifying—you didn’t quit being a scientist because you quit research?

Liza: Right.

Nancy: And your definition of a scientist is the one who is actively pursuing knowledge of science?

Liza: Yes.

Liza underscored the impression that she had inadvertently misspoken her identity as a scientist. Her insistence that she meant to say "research scientist" implied she understood a hierarchy within the classification of the title "scientist." I wanted to delve deeper into an understanding of this social structure. Through our conversation, we continued to wrestle with this mutual struggle.

Nancy: When you were at your conference you said, "Here I am Liza VanMauren from NCCC and here's all these big shots." So teaching is a lowly position?

Liza: Absolutely.

Nancy: On the science rung it's the lowest rung?

Liza: Yes! We should clarify those two terms. In the research community a teacher is a little guy. And, yeah, we intermingle [those words] "researcher" and "scientist" quite a bit, don't we? But it should be separated. Because there's research in that area, they—and actually, on the East Coast what the specifications were in the army was "research scientist" for science people who did research. That was the job description "research scientist."

Nancy: So, for example, another aspect would be an "instructional scientist" is that what you're implying?

Liza: No—no. All I am saying was that they specified both terms "research scientist." You know?

Nancy: Can you be a researcher without being a scientist?

Liza: Yes, that's why they put the "scientist" behind.

Nancy: How can you be a researcher without being a scientist?

Liza: I don't know. I'm just thinking about the same thing. I have such a pre-fixed—I never thought of it, "A researcher without being a scientist." Can you be? Are you a scientist if you research education? What is the definition of "scientist?" That would be an interesting—we need to check and see if there is a definition somewhere. There's got to be.

Liza has learned that she can best develop understandings through mechanical, definitive, quantifying, and precise definitions. Her struggle with the definition of "scientist" depicts how difficult this conversation really was for her. Her discomfort with the issues surrounding identity is clearly evident.

In her position as a community college instructor of biology, Liza viewed her role as one of "just teaching." She perceived this position was socially lower than one of being a full-fledged research scientist. To compensate, Liza tried to elevate her status (power) by incorporating major projects into her busy teaching schedule. "No, I will never be satisfied with just teaching. And I'm not saying that in a bad way." Liza continued to explain, "If I would want to have a more relaxed life I would just teach my courses and leave it at that. OK? I wouldn't worry about other things. But can I do that?" In essence, working on extra projects was Liza's attempt to "balance the scales"

between her identity disparity in her position as a research scientist verses her position as a community college instructor.

Holly: Scientist or just teacher?

Holly's position regarding her identity was a "work in progress." At the time when our interviews addressed this subject, Holly had never really invested any thought into such issues. In the beginning, Holly wanted to ensure that I understood she was a teacher whose subject of instruction happened to be science. However, by the end of our discussion, her resolve faltered.

Initially when asked if she thought herself a scientist, Holly's immediate reply was, "No." To clarify this response she explored her definition of "scientist."

> Well, in my mind, a scientist is discovering new things, and is always on the quest of the unknown, and I'm not. And…maybe that's…maybe my impression of scientist is research. "Are you a research scientist?" No. To me, in my mind when I think scientist, I think someone who is doing research, and making discoveries and probing the unknown, so, no. And actually I detest that. Slow…research…torturous, "Why am I doing this? What does this mean? Two years I've worked on this one project and I still don't have any results!" To me that's just wrong.

Clearly Holly did not associate her identity with that of a research scientist. Her collegiate experiences (while working in a chemical research laboratory) brought her to the conclusion she did not want that component of scientific exploration to be involved in her career.

Holly went on to question how teaching fit into her scheme of being a scientist. Here she asserts her identity as first being a teacher.

> Now, the broad perspective of scientist I don't know. I don't know what you…(pause)…you know, whose scientists? Are people who are testing water scientists? They're doing science-type testing, you know? I think the definition of scientist…again, I think…what's your perception of the term? I would say that I am a teacher, an instructor, and that's what I choose, and…once I found this position and found the joy that I get from being in the classroom and from conveying information and trying to get my students to learn and…that that is my passion. And I say, this is like, you know, they say "If you are a true salesman then you can sell ice to an Eskimo." And in my mind a true teacher can teach anything. A true teacher could teach anything if they had comprehension of the subject. They could teach it because they are they the disseminators of the information and they are mentors in learning. And they get the students to understand. I teach science because that's what I took in college. But I could enjoy teaching computers or literature or any…well maybe sociology, I don't know. You have to know the subject matter. But once I know the subject matter the teaching part is what…so I'm a teacher first who knows science. So I would say I'm an instructor, not a scientist, and I know science, and I understand science.

Here we are led to believe that Holly is secure with her teaching identity. She stated that she was a teacher who happened to know science. However, as she thought about the

social perception of what it meant to be a teacher, her security with this identity began to unravel. Holly began to justify the identity she had claimed:

> But I think that our administration, the educational environment we're in, and I think at the university it is, "Be a scientist and then teach. Be an accountant and then teach. Be a sociologist and then teach." Not, "Be a teacher, here's the subject." And I think that that's…for one thing you're downplaying the importance of a good teacher. You're perpetuating that idea that anyone can teach, and that teaching is a profession…what's the saying, "Those who can do; those who can't teach." Which is so unfair. You know? OK, scientist…I don't know, you'd have to define the term. I don't like research. I don't…I don't know.

Holly, too, called for a clearer definition of "scientist." She knew what her identity wasn't (a research scientist) but she did not understand what her identity was. Holly began to think through her definition of "scientist."

> Just like if we were to go and find someone who has the same training that we did, who took the research path, who took the discovery path. And we said to them, "I am a scientist." They would say, "No you're not. What papers have you published? What have you presented?" And we say, "Yes, but we have the training so I am a scientist. I've taken the classes I have the training." Just because we have the training does not make us [scientists], and just because they are teaching a class does not make them a teacher. Just because you have the title, does it make you that thing? "Well I'm teaching so that must make me a teacher." Well, you're standing in front of the class, it doesn't have anything to

> do if you're a teacher or not. But they assume because they are doing that, that it makes them one. We assume that because we have the training that makes us scientists.

Holly defended her identity (as an instructor) as one that required integrity and expertise. She drew on her opinion that identities are not stagnant labels by which someone is classified. She understood the notion of being a scientist as an "action" not just simply a title.

However the incongruence between Holly's identities had not yet been resolved. To further develop her sense of identify as a scientist, she reflected upon the identities of her undergraduate instructors of chemistry. When asked if she had any recollections about chemistry instructors that were not scientists, Holly replied:

> Well now, when I was at…[my undergraduate institution], though, all my instructors were PhD scientists. And they did no research, really particularly at that time, now it's changed a little bit down there, but they did no research on-sight. Their job on-sight was lecture, teaching labs, and keeping up on information. So I guess when I say I'm not [a scientist] because I teach I guess with that definition they weren't either. My perspective was that they were! Yes.

Holly questioned her resolve that her identity was one of just being a teacher. She deliberated whether her identity was multi-layered and more complex than she had originally thought. Holly began to look at her current identity through perceptions that other people in the community have.

> But after it all…how do you define [scientist]? When…[the high school chemistry teacher] called me and wanted a clarification on, "How is it that you get

> the neutrons?" Well in his eyes he probably did think I'm a scientist because of the knowledge that I have. Maybe it's because my idea of a scientist, from my experience, is so very different. And yet, you know…I go in the lab, and I set up the lab, and I understand how they're supposed to work, and I know how to make the things that I need to make so that they will work…so in that respect…yes I suppose I am!

Holly had an interesting reaction to this line of thought. She changed her perceptions of her own identity when it was viewed through a different light. By focusing on how others view her role at the community college, and by reexamining the work she accomplished within her own laboratory, Holly developed a new layer in her sense of identity. This layer embraced an association with being identified as a scientist.

Anna: Scientist or just instructor?

I had opportunities to conduct interviews with Anna over a five year period. Throughout this five-year time span we have discussed issues surrounding self-identity many times. The first time we spoke about the question of whether or not Anna considered herself to be a scientist, she was teaching physics at a well-known high school. The last time we spoke about this same question, Anna was employed as a full time instructor of physics at a community college. Throughout the four years I had occasions to listen to Anna's narratives I have never heard her relinquish the notion that she is not a scientist. Her resolve was not based on definition, as it was with Liza and Holly. Her tenacity was rooted in her own perceptions of what scientists are and her fervent desire to disassociate with that identity.

When Anna was a high school instructor of physics I asked her, "Do you think of yourself as a physicist?" She replied, "No, I'm a teacher." I reminded Anna that she holds a Master's degree in High Energy Particle Physics. To which she answered:

> I could never use it. I could never go into a company and use my degree and say, "Hi, I'm a physicist!" Now to my students I'll say I'm a physicist. But that's more for them to get used to the fact that women can be physicists. Even if I don't believe I'm a physicist.

How Anna represented her identity to her students conflicted with her own self-perceptions of that identity. In order to understand this, I asked Anna to clarify what she thought it took to be identified as a physicist.

> Even though I teach physics, I don't do physics. This isn't what physics is now…physics is not velocity and distance and time and all that stuff! I never do anything different. I don't do any research; I don't come up with anything. If I do any research, it's in computer networking or its in learning, but it's not in physics. So I'm not a physicist, I do not study physics. I teach physics. I don't do physics. I teach physics.

Anna's overemphasis that she was a teacher, not a physicist, was a call for clarification. I informed Anna that I thought of myself as a physicist who taught at a community college. Anna distinguished her perspectives regarding those who teach at community colleges verses those who teach at a high schools:

> You're treated like a professional I'm not. You're given the responsibility to manage your own time and your life and I'm not. Why do you think I want out so bad? I feel like I'm closer to flipping burgers than to being a professor on the

> scale. Even though I'm teaching the exact same class as…[professors at Central University], I'm paid a third as much doing the same job.

Inequity in salary and professional courtesies fueled Anna's perception of what it implied to be identified as a physicist. Anna believed another thing separating her identity as a high school teacher from a physicist's identity involved the constant repetition of work.

> I'm sick of teaching the same thing over and over. I wouldn't mind teaching computers, or teaching in an industrial setting, or teaching some other way. I enjoy the interaction. And I actually enjoy my students for the most part…but I'm sick of physics!

Anna's claim that she does not do physics directly conflicts with an understanding of how repetitious laboratory experimentation can be.

Four years later I had an opportunity to revisit the issue of identity with Anna. I wondered if, in her different role as a community college physics instructor, she had changed her opinion as to whether or not she considered part of her identity to be that of a scientist. Her reply was a flat, "No." She continued:

> I'm not a scientist. I'm not a physicist. I'm just a physics teacher. I'm happy not to be a physicist. It makes my stomach hurt to think of being a physicist. I just don't like it. I don't like it. I don't like it. I think it's because of the experiences I had. It has nothing to do with the subject. It still goes back to…[Central University].

Based on her graduate experiences at Central University, Anna has disassociated herself from a physicist identity. She reminisced about another woman, who held the same physics degree, hired in 1986 as an instructor within the university's physics department.

"She was allowed to teach, to be a lecturer. And I was never given that recognition. Somehow …[others] were perceived as being professional physicists, and I never was. I was never given that permission to be a physicist." Anna felt she was denied scientific and professional association with her physicist identity. She therefore had to acquiesce and concede her identity as a scientist. In her surrender, she maintained a nonthreatening stance and identified herself as just a physics teacher.

Summary: Issues of identity theme

It is important to examine the layered identities of community college instructors of science. The women science instructors in this study understand their identity within science to be different, than their university counterparts, because of their profession and association with the community college. There are the two reasons they are not distinguished as "scientists": first, because they are employed as teachers hence not "scientists"; second, they are employed at institutions of lower status, thus they are not identified as "scientists."

Let us explore the connotation and implication associated with someone who "just teaches." Historically, teaching has been largely a female population. In a society permeated with sexist conventions about success, the identification of teaching with women has often meant that teaching was held in low esteem (Rury, 1989). Engvall (1997) incorporates Beyer's (1992) findings:

> The perceptions were mistakable then as now, that if the "best students," male or female, do not choose teaching, but instead choose law, medicine, theology, or some other "science," then teaching will not be afforded the same societal "status." The unequal opportunities afforded white men in fields such as

> medicine, law, science, business, and the ministry, greatly affected the gender specificity of the teaching force. (Engvall, p. 46)

Women occupy a majority of the teaching positions, and according to Kottler, "Few groups are more oppressed, more manipulated, more scorned, more scrutinized, more controlled, and more cursed at than classroom teachers" (Kottler, p. 53). Within the fields of chemistry, physics, and biology, instruction is a task that has been relegated as an insignificant occupation. Women science instructors, then, are marginalized from an affiliation within their science. Therefore, helping community college instructors of biology, chemistry, and physics to develop their identities into that of a "scientist" will assist them to move in from the margins and reclaim their scientific association.

In their book, Women's Science: Learning and Succeeding from the Margins, Eisenhart and Finkel investigate the assumption that "real science" only occurs in research and laboratory investigation. They investigated places where people use or rely on science for public, social, or community purposes. They compared women's scientific roles between "lower-status places" and "elite sites." It was their finding that:

> Women in lower-status places or niches seem to be more centrally involved in science-related activities, more motivated to learn about science, more satisfied with their work, and more likely to be rewarded in equal proportion to men than has been reported for elite sites. (Eisenhart & Finkel, p. 228)

They also found that, "Lower status sites are better than elite sites in the ways they attract women to science, engage them in its practice, motivate them, and reward their success" (Eisenhart & Finkel, p. 228). Since lower-status places—community colleges—attract and engage more women, it therefore becomes imperative that those teaching science are

given an identity which lends authority to their craft. This same study goes on to concede that:

> Furthermore, lower-status places are more financially precarious, more politically tenuous, and more public than elite sites, thereby offering participants less economic security, fewer stable networks, less political clout, and less personal security than elite sites. In these ways, lower-status sites are not better places for women. (Eisenhart & Finkel, p. 229)

Giving community college instructors of science an identity associated with the scientifically elite would empower their stance in light of difficult circumstances.

Eisenhart and Finkel (1998) have a warning for women outside of elite science sites:

> Women pay a special price for rejecting elite science. Our alternative sites of science and engineering are lower-status, sometimes unsafe, and financially precarious; they also hide prototypically male characteristics of work behind a discourse of gender neutrality that disadvantages women. Most of the women we studied did not realize that they alternative sites, which offered them some relief from the greediness of elite science and engineering, contained their own limitations. Yet these limitations are subordinating: they ensure that participation in alternative sites leads to subordinate status in science, and they do so in a way that is more consequential for women than men. (p. 231)

It is imperative to bring women community college instructors to a realization of their surroundings. Through resistance they can be empowered scientists that affect real learning in the course of their students' lives as well as their own.

Universities, medical schools, and private institutions—elite sites of science—reserve the right to identify their instructors of science as professors and scientists. Women community college instructors of science must examine the extent to which they will accept the hegemonic forces placed on them through elite science sites. In their resistance to the demands of high-status science institutions, such instructors will find their professional identity reward. As scientists, women community college instructors of science evoke a very different image from that of the dispassionate, laboratory scientist, free of political, social, or local concerns. This new identity is a key to the dawn of redefining science.

The women of this study faced difficult decisions as they planned their professional careers within their natural science disciplines in relation to their personal lives. Most professional decisions were made without the input of any mentors, role-models, advisors or counselors. Their decisions are layered with complicated considerations indicating a constant struggle between their natural science professionalism and personal identify. In order to "make meaning" of the scientific knowledge they possessed against the issue of financially supporting themselves and their families these respondents found that the community college offered an employment environment where both needs could be met.

Like many other women, my respondents found that their science knowledge was valued at the community college; it filled a need for the institution (i.e., faculty member) and it filled a need for the person herself (i.e., a job). At the community college they could earn a decent living, teach, and continue ties within their scientific expertise. "Women professors are more apt to teach at community colleges, where 50% of faculty

are women. At community colleges, women enjoy a smaller pay differential, earning 93% of what men earn" (Halstead & Loy, 2007, p. 2). The community college environment is simply more receptive to women faculty than the 4-year university environment. There is a greater gender balance within the faculty ranks at the community college. Taking a teaching position at the community college represented a practical and secure employment opportunity for these three respondents.

Another advantage that my respondents found through employment at the community college was that they were able to "practice" their science and simultaneously balance their home lives. The "publish-or-perish" atmosphere that is common at a 4-year university is not found in the community college faculty environment. My respondents found that this de-emphasis in the production of up-to-the-minute research gave them a scientific option to not have to sacrifice being a professor with being a parent. Further, they found that achieving tenure was a less critical issue at the community college compared to a 4-year university faculty member. All three respondents achieved tenure within the first 3 years of full-time teaching at their community college. The community college atmosphere offered more flexible scheduling and class time arrangements for these respondents as caregivers within their families.

Simultaneous with the relief from the production of research articles and attainment of tenure status through their employment at the community college, the women of this research found they had sacrificed what they once understood to be their "scientist" identity, certainly their "researcher" identity, and had assumed a "teacher" identity. Moreover, they found their teaching loads were quite high; generally single-handedly conducting 5 or 6 different sections each semester. Their faculty teaching loads

also consisted of other components such as office hours, help sessions, service on institutional committees, and the ubiquitous "duties as assigned" clauses in their contracts.

Anna brought up an interesting point when she discussed the notion that it would have been beneficial for her to have received some graduate training in teaching methodology and teaching alternatives (i.e., at a community college), "The TAOS class I had to take as a graduate student was worthless. I really needed to find out more about teaching and learning methods so that I could develop my own talents and grow in my own teaching confidence. I would have greatly valued this information! When you increase the options a woman has, there will always be a benefit."

The community college faculty position was an attractive option for the respondents of this study. The conscious decision to work in a community college, for the women interviewed, stemmed from prior work experiences that were less flexible or less enjoyable than teaching at the community college. Anna completely disliked her high school teaching experiences. Liza wanted more one-on-one contact with students outside of a research setting. Holly found that her "first job" teaching as an adjunct instructor actuated into a full time teaching position. All of the respondents in the study had experience working in other settings before teaching at the community college. This comparative lens gave them an appreciation of their current positions.

The postsecondary educational experience holds a crucial role on the decision making process for women in the natural sciences as they choose a profession within their STEM field. According to an article written by Wilson (2004) in *The Chronicle of*

Higher Education, women continue to experience biases, marginalization and discrimination during their graduate school training:

> While girls get encouragement and earn good grades through high school and even college, subtle biases seem to kick in during graduate school. When young women come to Ph.D. programs, their undergraduate grades are just as good as those of their male colleagues, academics say. But after six or seven years, "very few women come out on the top of the Ph.D. class," says a female economist at a prominent research university, who asked to remain anonymous. "And I don't think it's because they're dumb" (Wilson, 2004, p. 5).

Wilson continues with the discussion, "One possible reason is that graduate students' success depends heavily on their relationships with their advisers. And male professors—particularly in male-dominated disciplines…may be less comfortable with female students" (Wilson, p. 5). If male professors are more comfortable mentoring and nurturing their male students, then the female students are left stranded without someone in their corner. This discussion takes us back to the notion that the development of community and a strong support system around our women students in STEM fields is a crucial element toward their academic achievement and success. Although blatant discrimination is certainly a criminal activity, such examples of covert inequities keep the patriarchal regime at the helm of power structures. We need to scrutinize and elucidate such under-the-radar practices. Anna articulates her own personal experiences:

> I gave up the thought of being a scientist. I became an educator, but always felt bad about "settling" for this, even though it matches my skills, interests and personality much better than being a 'real' scientist ever would have. I fought to

> get a PhD, but have never been very proud of it except in a defensive way. I always make the point of saying my PhD is not in physics, it's in education, as if I didn't want to claim status that I didn't deserve.

Another aspect of how women's postsecondary experiences influence their professional choices within STEM fields is that students tend to emulate their role models. It is difficult for women to locate suitable female role models because of the scarce female population within these fields. Female graduate students can literally spend years trying to locate and become acquainted with female professors at work within STEM fields. This absence sends the clear message to female graduate (and undergraduate) students that they are not welcome—that the field is too far out of their reach—and that STEM fields remain gendered and impenetrable. The women of this study certainly concur that their graduate experiences were made more difficult because of the total absence of strong female scientific role models. "Where are all the women?" is a question that persists and resonates throughout the halls of science, technology, engineering, and mathematics.

Issues of community: Where is the support for women in college and for women teaching at the community college?

Another shared theme emerged from the three respondents' narratives through the research questions of this research. Through the interviewing process the issue involving community became immediately apparent. Anna, Holly, and Liza unveiled how they were negatively impacted because of a lack in support communities. They addressed a

mutual concern about what they perceived to be a lack in guidance and mentorship for them as learners within the natural sciences. Their narratives were very revealing as they stressed the importance of having access to a supportive community of mentors, advisors, and counselors.

Within this common theme, all three respondents reveal their own experiences involving issues of community. First, Anna will describe her experiences of having a complete lack of support community on which she could depend. As a university student, Anna felt isolated from mentors and excluded from other students. Second, Holly's narrative will illustrate the important role instructors can take as advisors. Holly indicated how she tried to find a balance between the social supports offered by peers with the intellectual support offered by an instructor. Next Liza expressed how communities were important tools of development in her life. She also described how she misinterpreted her role within a support community (a research team) as one of dependency. Ultimately, Liza used her experiences of dependency within a community as a point of personal growth and independence. In conclusion, all three respondents revealed how they mentor (in order to foster a sense of community) within their own classrooms and student contact experiences.

Anna's Case for Community

When I was in the process of transcribing Anna's interviews, I had an opportunity to share my thoughts and findings with a young undergraduate student, named Hope, a work-study student at the North Campus of Central College. We discussed a couple of points that emerged from Anna's narrative. Hope's immediate response was, "None of that stuff could happen today." She believed that the male power structures and

hegemonies had certainly changed and were essentially nonexistent. Hope alluded to "those types of things" that happened "back then." She claimed that professors could not "get away with that stuff" today.

Although I was saddened that Hope did not realize the pressing issues we discussed did continue to exist in our society, I was also intrigued by her inexperience. I then asked Anna to respond to Hope's denial. Anna, too, was disheartened to hear that Hope was clearly unaware of our society's dominant patriarchal structures. Anna commented:

> Would it be different today? No, they're the same damn people. There is no difference. They haven't changed. You have [male professors] who create little [male professors-to-be]. They replicate themselves. And they still think they are better than anybody else. And they still, you know, can't stand the thought that a woman could do anything, much less, help them do anything they wanted to do.

On the other hand, Anna personally identified with Hope's naïve responses. As an intelligent woman in the field of physics, Anna recalled that she too felt such things could not possibly happen.

> [Hope] doesn't know what she's up against yet. Think about when you were an undergraduate. I mean the whole world…it never dawned on me that the world didn't think like I thought. And I have half a brain, you know? I'm usually pretty proud of the fact that I can see a lot of the sides to the issues. But I had no idea. I had no idea that people would be like that…that they're so uncaring.

Due to her experiences of isolation and estrangement from the community of physics, Anna interpreted issues of power, patriarchy, and marginalization as "uncaring." To

Anna, callous indifference was a tool of marginalization. She went on to tell why issues involving the lack of a support community for women compounded her difficult experience of being a female undergraduate and graduate physics student.

> A lot of the research…like a lot of the research about what I've done [at the high school]…has helped me because I've really spent a lot of time trying to understand what it is saying. One thing I found is that, for females, networking is important. Well, there was no networking in grad school. There was no support system that a female would recognize as a support system. There was a support system that a male would recognize as a support system…of constant competition…keep me on my toes…keep me going…cut me down so I can come back…that kind of thing. But there was no female network there. We had one, but who was our network with? The secretaries. We didn't bond with [professors of physics]. I mean we bonded with [the different physics department secretaries]! Those were the people we bonded with. Those are the ones who are so happy to see us when we come back.

Anna's understanding of our common graduate experience in the physics department was very insightful. When Anna asked whom I bonded with in the physics department, she brought me to a very harsh realization. I suddenly realized that my support community, as a physics graduate student, did not consist of mentors, advisors, counselors, or instructors. Rather, the support community I knew consisted of my family (who was unfamiliar with notions of graduate physics), a few close friends (one in physics but the rest were not), and the departmental secretaries (who knew the "ropes" of the department). Anna was right. We had minimal contact, interactions, and

encouragements from the professors of physics. This denial of access to the dominant community (as defined by physics academicians) had secluded us from structures of power all the more. A lack of mentoring and counseling from within the department of physics greatly affected our educational outcomes within the department.

Anna's perception of the importance of having in place communities of mentors, advisors, and counselors for students is revealed through her comments:

> I would have done so much better had I been recognized. My whole life I've thought that the whole experience of graduate school would have been different had I been recognized as having potential. And I know I had the potential, I had the grades. I had one of the highest GPA's of any American student, not the Chinese, but of any American student. But I still felt, you know, I didn't feel competent to study, and I didn't feel like I could actually learn quantum mechanics…the whole thing.

Anna emphasized the importance of mentoring as a tool of encouragement. She believed that if she had had access to an established support community (one which she recognized as a valid source of encouragement and mentoring) she would have excelled beyond the educational level actually realized as a graduate student of physics. "I had some teachers that I could talk to but they never took a leading role. I really needed more direction and it would have been nice to have somebody who could mentor me." Anna recognized that without a positive support community, those being marginalized were further oppressed.

What effect did the absence of guidance and support have on Anna? How did Anna make decisions about where she should be and what she should do? Continuing her discussion about the counselors in her life, Anna described how she found direction:

> I never had any adult that ever tried to direct me or help me with anything, to be honest. The only people that did any direction or helping were on the negative side. Like my viola teacher who told me to find another career field…and I did follow his advice. Then there was a teacher at [my undergraduate institution] that was so sexist, and he—I don't know—he tried to get me to quit physics basically. At least that's my impression of him. But I didn't.

Anna wished that she reversed to whom she had listened. "I wish I had stayed with music. And, you know, I let that stupid man tell me that I was not good and did not have what it took to be in it." Anna realized her viola instructor had redirected her life through negative reinforcement.

> If I had stayed in playing the viola—this was my freshman year—there were no other viola instructors! I would have had to be with him for four years. And this guy—this probably has more to do with it than anything—this guy, when I walked into his studio, he told me I didn't know how to bow. I didn't know how to hold the viola? I couldn't do this or that or the other thing. Now mind you, I was first chair at the Kansas City Symphony and Kansas City has 150 members in it and I was first chair violist in that for two years. And I had been to All State and I had been first chair there. You know, all these things. In All City I did a solo. It wasn't true! What he was saying wasn't true! And yet I let him tell me that it was true.

At the time, Anna did not feel qualified to question the statements her viola instructor made. The university's viola instructor wanted Anna to hold the instrument in a different manner than she had been taught.

> So the first thing he did was to remold my fingering…how I held the instrument. And then the next week when I came in he asked me to play something and I couldn't play because he had redone my fingering and so he decided that I just had no ability. You know? He asked me to play something after, "Oh nobody's ever taught you how to do that kind of bowing?" "Well, yeah, they did but they taught me the way they taught me and not the way you're doing it." And it's like, he told me I had to change, then he told me that I was bad. And it was awful…simply awful. I was such a wimp and I had so little backbone that I just took it. Instead of going up to him and saying, "I will not study with you anymore. I will study with somebody else." You know? I didn't do that.

As a university freshman, Anna did not believe that she had entitlement to request another viola instructor. Without a support group, an advocate, or a mentor/counselor Anna was alone to make blind decisions. "Nobody ever sat me down and said, 'you have this interest,' or, 'you have this talent.' You know? 'Have you ever thought about doing this, that, and the other thing?' No…that didn't exist." Would a mentor have helped to open options for Anna rather than shut doors? Would an advocate have presented Anna with viable alternatives? Had such a person existed, perhaps Anna never would have gone into physics.

> I really liked the anthropology class. That's probably the only class that I took the book and actually read everything. I just ate it up. Now, why, why was that

> never brought to my attention? Do you know? I don't know. And I feel like the music people told me I didn't have talent, so I went to math. In math I got B's instead of A's. So I went to physics. You know? It had nothing to do with me. It had to do with someone else's judgment of me…or who was in the class…or what topic happened to be cool...just stupid reasons.

The absence of guidance and support left Anna to flounder on her own. Without mentoring she searched for direction in a "hit and miss" fashion. What ultimately brought Anna to physics? She sums up her reasons:

> It was something that was hard that I could do well in. You know I never loved [physics]. I thought it was neat, but I don't think I ever—it's not something I would ever do just for fun. I don't know…I think it's more of an ego thing than it is anything else.

In the end, the answer as to why Anna chose to major in physics had nothing to do with a directed career or informed guidance.

Support can come from different aspects of community. As a student of physics, Anna felt that the professors of physics only distantly participated in her educational development. What about the community of learners that surrounded Anna? Based on my own undergraduate experiences, of actively participating within a group of physics students, I wondered if Anna had experienced similar support. During one particular interview we laughed how students of physics were often referred to as "nerds", "geeks", and "brainiacs." Suddenly, Anna made a somber comment that completely changed the tone of our conversation:

> Actually, this is weird, but I was excluded from the "geek world"…that really made me feel awful. Because at [my undergraduate university]—and [that place] was just a different world—they had the "geek house." All of the people that I wanted to be friends with, basically, were part of this "geek world." And I never fit in with them. I wasn't cool enough. I was probably overweight, you know, that probably played into it.

I was astonished Anna perceived that her inability to gain entrance to the undergraduate student physics society was because she was deemed not "geeky" enough. Her statements seemed to imply a type of contradiction in terms.

> Almost everybody at [my undergraduate university] is a geek. Do you know what I mean? It is a private, and academically challenging, school. And so the people that were there were all geeks…so it was a good thing to be a geek! I just wasn't cool enough…I wasn't "geeky" enough...I wasn't one of them.

I asked Anna if the concept of community had always been difficult for her. She replied,

> It always is…that's the trouble. I never fit in anywhere. I still don't. I don't know why. Is it a sophistication? Am I not sophisticated enough? Am I not willing to play the game?

Anna lamented that, as she presently pursues her doctorate within the Curriculum and Instructional Technology department, she does not recognize a support community of mentors. She still feels isolated:

> I think [as a graduate and as an undergraduate student] I needed somebody interested in my life…period. And I didn't have that…somebody in the professional world interested in my life. And I still don't have that. I think

> maybe that's why I'm "putzing" around with this stinking PhD. You know? I'm still directing myself.

Generally, doctoral students select a committee of professors who will support and mentor them through the difficult phases of writing a dissertation. If Anna feels disconnected from her graduate committee (and her major professor) then the process has broken down somewhere. Most likely Anna will need to reconstruct her doctoral committee. Mentoring, for graduate students, is essential to their success.

Anna's narrative developed a case for community. Throughout her collegiate experience, Anna believed she had been deprived the benefits offered from a support community of mentors and counselors. She believed that she was ineligible to participate within the support community of co-learners due to issues of status. Anna felt isolated and rejected. This lack of emotional and intellectual support and assistance has greatly affected her throughout her life experiences.

Holly's Case for Community

Holly also had much to say about the importance of support communities for students. She considered mentors and counselors essential to students' successful academic growth. However, in Holly's own personal experiences, she perceived there had been very little input from a support community. She recounted her high school guidance experiences:

> But, well, our guidance counselor was very un—well—useless...just useless. I had no direction of possible careers. I had no careers. I had no direction of things you can do…nothing. I had no guidance. So it was kind of…I don't know how I ended up in science. I suppose it was I was at the top of the class and I did well in

> science, and so, it was just the natural thing that, you know, if you're smart you go into science. I don't know that that was my favorite thing. I loved school. That was my favorite thing. It was just school. I didn't care what subject it was. Some things I liked better than others.

In high school, Holly was influenced by one of her science teachers.

> In my freshman and sophomore years I had a gal who taught science, and she was young and not much out of college. I think I [was drawn to her] probably because of her thought that "girls can do this." Then she left, and the guy that came that actually taught my chemistry class, I hated him. I enjoyed the chemistry, I mean I did well on it, but I really detested the teacher.

Ultimately Holly may have been influenced to select chemistry as a degree major, due to the impact from her first chemistry instructor. When asked, at a different time, why she believed chemistry was her chosen major, Holly replied, "I have no idea! It was just, kind of, one of those things." The effect of a positive role model is long-lasting. However, Holly seems to be unaware of the reasons how and why she chose to study chemistry.

Holly had the advantage of coming to understand the impact and importance of mentoring through one of her brother's experiences. Holly is the third of four children in her family; she has two older brothers and one younger sister. As Holly's brothers graduated from high school and began their university experiences, she compared their two different encounters with mentors.

> My oldest brother, when he graduated from high school, started at Middle University, and I think he had a 31, 32, or 33 on his ACT's. Of all of us, I think

> he's probably the most creatively intelligent. And [he] was into science. After the first quarter at Middle University he flunked out because other things were more important. He had a horrendous load that first semester, and flunked out. That was kind of scary! My next older brother graduated [high school] in 1979, which was just a year ahead of me. And, although he's only about 5'7", is sports, sports, (and always has been) sports. He wanted to be able to play sports collegiately. Well at 5'7" you don't play football for Middle University! And his P.E. teacher had gone to school at [a small private university] and sent a tape down, and they looked at [my brother] and recruited him to play football. So he went to [a small private university] to play football, and he did quite well. So as a senior in high school, my one brother…who was just trying to find himself…I mean he had a band and all that…he was truly trying to find himself. And then my other brother is at this small school and doing quite well.

Holly's oldest brother had no guidance or mentoring as he entered the collegiate arena. On the other hand, her second oldest brother had the advantage of an athletic coach who took special interest in his interests and abilities. Holly clearly saw the advantages offered to her second oldest brother through the powerful impact of a mentor. She interpreted that these advantages contributed to his overall success as a university student.

Holly went on to express how she originally intended not to attend the same institutions that her brothers had attended. She spoke of her mind-set at the time:

> I didn't know where I was going to go to school. I had, after the experiences of my brother, decided that it was going to be a small school. And, of which there

> are lots of small private schools in [our state], and I adamantly said, "I will NOT go to school where [my second oldest brother] is going to school." He and I fought like crazy. Absolutely no-way no-how was I going to the same place that he was.

Holly toured different college and university campuses around the state as part of her selection process. One day, she found herself visiting the same campus where her second oldest brother was a student.

> We visited [the same university my brother attended]…and that's where I decided to go. Even though I swore there was no way I was ever going to school the same place that he was. That's where I ended up. I looked at others. And, really, the people there were very friendly.

In our examination of Holly's narrative, it is logical to ask why Holly attended the same university as her second oldest brother. Was she influenced by this brother's success? Was she in search of a similar story for herself? Holly had seen his prototype for accomplishment. Her brother's mentor (the athletic coach) assisted in developing her brother's personal goals and interests into a reality. Through the mentor's actions (he understood her brother's desires, got personally involved, sent a tape, sent a letter of recommendation, supported her brother's vision) he had helped to develop the personal aspirations of one student. Holly recognized the influence the coach (mentor) had on her brother's overall success while at the university. Holly's decision to attend her brother's university was crystallized when she discovered the campus's friendly environment. In her statement, "the people there were very friendly" we discern that Holly's heightened sense of community had been reinforced.

Holly is a first generation college student. As she did not have much didactic assistance from her parents, I inquired about where she personally found support while attending the university:

> I don't think I ever really did have guidance. I think it was…I looked at my brothers and what happened to them…and modeled from them. And maybe that's why I picked and chose and had to say, "Well this is what my major is going to be" because my [second oldest] brother knew…he was going to be a lawyer…end of discussion…that's it. There was no discussion of what I enjoyed.

In the first semester of her freshman year, Holly declared a double major in chemistry and biology. As an undergraduate student of chemistry, Holly received the Outstanding Freshman Chemistry Award from the university. This departmental show of support was very reinforcing for Holly. "[The award] probably influenced my staying in [chemistry] because it was affirming to me that I was excelling." Ultimately Holly dropped the biology component of her major and focused only on chemistry. She claimed that she may have "ditched the chemistry" at some point had she not received the award.

As Holly further developed in academia she found there were some classes in which she particularly enjoyed being a student. She felt herself being drawn to certain instructors. "It occurred to me that the reason I was choosing certain [classes] had nothing to do with the content as much as it did with the instructor." In particular, she described a conversation with her undergraduate instructor of organic chemistry:

> He told me that he enjoyed having me in class because he always could look at me and know whether or not he was getting through. Because evidently I nodded back at him a lot…and when he asked [questions]…you know I wasn't very

> vocal. I wasn't the one who answered all the questions, but if no one answered the question, and I knew, I would wait to see if anybody else was going to answer it, and then if no one did then I would.

Holly was pleased that this one particular instructor had recognized her contribution to the classroom. She felt reinforced by his statements. His affirmation of her presence validated her sense of location within the community of chemistry. However, the instructor's comments presented Holly with a dilemma.

> So, you know, it was again not wanting [other students] to know that I knew all this [information] and yet wanting the instructor to know that he…what he was doing wasn't futile...[I wanted the instructor to understand] that I did know what he was talking about. And that, of course, made me feel good that the instructor enjoyed having me in class.

Holly found herself in the predicament of having to choose between two communities. She felt that social support from her community of learners would be threatened if she actively answered questions posed by the instructor. "I didn't want to be singled out and I didn't want the other students to [think of me as] the curve-buster-overachiever. I didn't want them to like me or not like me based on how I did." On the other hand, she also felt that the intellectual support from her instructor might be removed if she failed to answer his questions to the class. Holly found that she walked a fine line between opposing communities of support.

Holly had a unique conflict with community compared to the other respondents in this study. Holly's sense of community was threatened by her own intelligence. To Holly, being involved in a supportive community of friends was very important.

However her intelligence had, at times, isolated her from the people she sought for friendship. Based on her prior experiences in high school, Holly was justifiably insecure in regard to the rejection she may have received from her collegiate social community. "There were people in [my high school] class that wanted nothing to do with me because of where I was in comparison to them. That was very painful." To compensate, Holly actively sought out communities of support through her enthusiastic involvement with many different groups. While in high school she played softball and basketball, sang in the choir, played flute in the band, and participated in speech contests. Although Holly always maintained good grades, she kept her academic excellence secret from her friends. "I didn't want people to know what my grades were or anything like that. And I think it was because of the fear of being ostracized and 'oh, you're just too smart.'" The pattern of concealing her intelligence to protect her social community of support continued to be play a major role throughout Holly's educational experiences.

Although Holly enjoyed friendships with women in her sorority, she found it difficult to cultivate friendships among groups of students in the technical classes she took. When Holly was enrolled in the second semester of calculus she found, as the only woman in the class, a new form of isolation—gendered seclusion—from the dominant support community. Although it was a small class she assessed that she was "the only female—and the instructor was male—and so here I was in this room of geeks!" Holly had no propensity to become involved within the calculus students' community:

> They were geeks! There was one guy…he was really the only other normal person. I mean the rest of them were just geeky and thought they were real brainy but they weren't! That just drove me nuts. You know? And that was very

> uncomfortable for me. Then of course I didn't have anybody amongst my friends who was taking that [calculus class]. And I didn't seek out any of these guys to study with. And I struggled. I can't remember what I got…I think a B or B+…which could have been one of the top grades in the class…but it was such a bad feeling for me to not have a group feeling.

Based on Holly's experiences in organic chemistry, I wondered whether or not the calculus instructor had provided any guidance, or motivation, for her as a student. I asked her what role the instructor of that class played in her seclusion from the community. She replied:

> I didn't know the instructor very well. I never would have sought out the instructor for help…because I was just supposed to be able to do [calculus], and know how to do [calculus]…and of course I didn't. And with the load I was taking—I think it was the first semester sophomore year and I had a 4-point. I remember that feeling of being out of place…being a girl…and being out of place.

Holly sensed a lack of cohesion between support communities. She did not identify that the other calculus students welcomed her into their community. She did not recognize the instructor as having provided any form of guidance to her as a student.

> I don't remember the instructor giving me extra attention, or special attention, or saying, "I'm glad you're in class because you are doing well," or anything like that. So there wasn't really any encouragement from him either. And where I was getting that encouragement was in the science program [and the chemistry instructors].

Without encouragement, support, or mentorship, Holly had no proclivity to proceed in her studies of mathematics. Rather, she sought support and guidance from alternative avenues that showed interest in her development as an individual.

As Holly sought support from the science program, she first looked to the community of learners to which she belonged. Again she found a lack in available group support. "They didn't have a chemistry club…we didn't have anything…so there was no group that you belonged to. You were kind of out there on your own." Her next alternative was to turn to the community of instructors for help and backing. The primary mentor providing such encouragement and support for Holly was again her organic chemistry instructor. His classes were the ones she really enjoyed. Unfortunately, this instructor went on a sabbatical from the university at the end of Holly's sophomore year.

> [He] went on sabbatical that year…which probably had a big effect on me not going back my senior year. I think had he been there my junior year that he would have been able to talk me into coming back my senior year. But he was on sabbatical so I had no contact with him.

I asked Holly if she felt abandoned. She answered, "Yes! I needed his encouragement and his insights into, you know, what you could do." When the primary mentor in Holly's undergraduate life was removed, she sensed that there was a complete lack of encouragement and guidance; hence, as a beleaguered student of science, she dropped out of college.

Holly's narrative is replete with the importance of strong support communities. Holly negotiated between what she perceived to be opposing communities (fellow students verses instructors). Although guidance and support can be derived from a

variety of sources, we see through Holly's experiences how a caring instructor can provide valuable mentoring for a student.

Liza's Case for Community

As a student, Liza's experiences with support communities were different from either Anna's or Holly's. Liza was able to locate herself easily within support communities during her educational experiences in Austria. She described herself as a popular and outgoing young woman, one who made friends easily. Although friends did not always share her same intellectual pursuits, she was able to draw strength from them as a means of support.

Growing up in Austria, Liza was recognized for her athletic prowess. When she was 16 years old she was ranked as third fastest in swimming the breaststroke in Austria. However, since she "tested in" for admission (a less preferred alternative for entrance) to the gymnasium (rather than recommended by an instructor) she was "automatically labeled as the 'dumb one.'" She felt excluded from the community of academically excelled learners.

> I was very popular, needless to say, because of sports. I was certainly not popular for my brain at that time. So even I was labeled by the teachers as the "dumb one" in the class…the good looking dumb blonde…but [now] I am the only PhD in my whole class! All the "bright" ones, or the so-called "bright" ones didn't make it. They made it to high school teacher [level] that was the max. I had the drive.

As a youth, Liza used her exclusion from the intellectually elite group as a powerful motivator to propel her to success. In many ways, Liza used her absence from this

associated community as a tool by which she was driven. Soon she was known throughout the gymnasium for her academic ability. Liza had gained entrance and acceptance into a supportive community of academicians.

We find a powerful example of the positive effect of mentoring and guidance as Liza drew to the end of her undergraduate work. In the latter part of Liza's undergraduate studies in biology, she wanted to enroll in graduate classes to further her academic development. She approached her major professor about such a move:

> In order to get those specialized courses, like electron microscopy, I had to be graduate status. And so he let me. But his first response was, "Why don't you stay behind the stove?" And I said, "By now you should know me well enough!" And he said, "Yep!" But from then on he was nothing but supportive. You know, he saw at once (I got a desk, you know, with the graduate students) I was working hard.

Liza basked in the approval she received from her major professor. She was diligent and worked hard in order to preserve his approval. At that same time, Liza's boyfriend, Albert, worked in the identical graduate program as she did. This collaboration furthered her senses of support and community:

> You know it was fun because we worked on similar areas. So we were a real team. And we would have rat colonies together. We just…we were a team…you know, a research team. You know? Those were good years. Because of that support we had for each other we could, you know, finish things that others could only dream about. We would discuss our findings…so it really was teamwork.

Through Liza's positive experiences with an associated support community, she believed she was capable of going further than many others.

For Liza, the association with such a powerful research team came at a high price. Her valued research team community was as a double-edged sword. On one side, through her community, she was further equipped to conduct and follow insightful research trails. On the other side, she felt that she lost her independence as a research individual. Through her perceptions of the strength of the research team, Liza paid an emotional cost. The mentor of Liza's research team (her major professor) was biased in his advocacy for the male team member:

> And we published [our research findings]. [Our major professor] always felt that Albert's name should be first [on the publications] because he was a man, and he will need it, and I won't need it. So that was a struggle. At that time I struggled with that…but I was in love…so I took it. And then it came to the point that I thought I couldn't do anything without him. I was getting really dependent on that teamwork and that relationship.

By not allowing Liza's name to appear first on their research publications, the major professor had caused Liza to question her authority within the team. Liza was made to feel that her contribution to the research team was second rate. This struggle for validation undermined her position. Liza described her perceived weakness since she depended on Albert to be the major component of the research team:

> I thought that he was the core of the team. You know, I was absolutely convinced that without him, I would be nothing. So that's when I became weak. That's when I became dependent. And I didn't much like it, but it happened so gradually

> that by the time I realized it…it was too late. You know, I honestly believed that there couldn't be a Liza without Albert in the research area.

The support community that once elevated Liza now destabilized her authority. Liza felt marginalized from her own research community.

Fortunately for Liza, a Hungarian research scientist took interest in the publication (by Liza and Albert) about electron microscopy. This external research scientist came to Austria and stayed for three weeks in order to learn the laboratory techniques Liza and Albert had developed. As graduate students, they worked intensively with the Hungarian scientist.

> [The Hungarian scientist] realized that the core of the scanning stuff was [mine], and that the light-microscopy was [Albert's], so she took a liking to both of us. [Back then] they always thought that a man scientist was doing better than the female scientist. That was a given. It was very hard for them to grasp that [a female might have] the brains behind it. I think [the Hungarian scientist] realized it because when we wrote the dissertation she took special care on mine. You know, [she gave me] a lot of suggestions. You know, I got a dynamite review from her. She was essential for both of us to get through as quickly as we did. We were really her…she was our mentor. And because of her recommendations, I actually got five offers in the United States to come over as a post-doctorate, and Albert got none.

The Hungarian scientist filled a need for Liza as a mentor. Through her guidance, Liza flourished and was given the permission, direction, and motivation to succeed

professionally. Liza was lifted, by her mentor, out of a role of dependency into a role of leadership and authority.

After that time, Liza's experiences within research communities completely diverged. Liza developed great self-confidence and independence. We find evidence of Liza's autonomy from counselors and mentors through her professional career. Prior to her appointment as a full-time biology instructor at the North Campus of Central College, as a research biologist, Liza found funding through many different laboratories. During her career, she had experienced roles as a co-investigator and as a research subcontractor. However, the first time she was awarded funding as the principle research investigator on a project she was invigorated. Liza explained:

> Here I was…finally a principle investigator with funding…with my own lab…with my own budget…with my own design…with my own everything. [There was] no influence from anybody! And guess what? I was a success! I was so much of a success that there was a lot of jealousy coming from other people in the surrounding labs. I got major funding…and it was just fantastic.

Liza had been liberated from the dependency of requiring another person (from the research team) to fulfill her needs of community. She did not look for direction or approval from other experts in surrounding laboratories. Liza had a research vision and she had been given the tools to carry out the work.

Liza's narrative is a valid call for community among learners. Her description of the effect that a support community can have on its members is one from which we can learn. Liza showed how a mentor equipped her to become independent and self-directed.

Summary: Issues of community theme

Today, the respondents of this research, in very different manners, incorporate past personal experiences (associated with mentors, counselors, and support communities) into their lives. We will examine how Anna, Holly, and Liza have assimilated their experiences, as students of science, into their current roles as instructors of science.

As a full time instructor of physics at a community college, Anna serves informally as a faculty advisor. Through her lived experiences, she believes it is important for students to work toward specific and attainable degree goals. She recognizes that her own degrees (bachelor's and master's) in physics have limited "employability" status associated with them. Generally, she steers students away from choosing physics as a major. Anna as a mentor:

> I rarely encourage kids to get a degree in physics. I rarely do. If they bring it up and I can see that they've got the interest and the drive to say "this is really cool," then I'll say, "go for it." But if they're looking around like. "Well maybe math, maybe science, maybe engineering…" I say, "Go engineering. Find a job. You can branch out from there." That's ridiculous.

What Anna believes to be "ridiculous" is the dead-end nature of a degree in physics. She is unaware of options, other than graduate school, available for a student graduating with only a bachelor's in physics. She believes that students with engineering degrees have a much higher probability of being employed, within their degree area, after graduation.

Anna believes that "mentorships" are recognized to a greater extent now than when she was a student.

> [Now] I think there's more support and that networking is happening. I think the "mentorships" that are developing are beneficial to boys and girls. And so…mentorship is a female concept though…it works. And group work is a female concept, and that's why men in general are very uncomfortable with that. "Well I want to do that myself." That's because you're more competitive!

Anna's narrative reflects how work can be accomplished in different ways. She distinctly associates mentoring and collaboration (group work) as "female concepts" separate from traditional approaches for accomplishing work. She introduces the idea that techniques for approaching work are gendered in nature.

Within her classroom, Holly works to build a rapport and trust with her students. Holly hopes that if her students find themselves needing help they would be comfortable enough to seek guidance and support from her. In a discussion about Holly's role as a mentor, she related the importance of community within her current classrooms:

> And now when I look back and see how isolated I was. It was self [isolation]…I didn't seek out…it's not like people rejected me—like I sought a group and they pushed me aside—it was that I didn't know how to even seek. And there was no…and I think of that now…and I think it's why…in my classes it is so important to me that they know each other. It is so important that they talk to each other. It is so important that they start to not isolate. Because I always isolated! I knew who people were—I probably even knew their names—but I probably never talked to them.

Holly believes that, through actions of her own, she was isolated as a student majoring in chemistry. However, she recognizes that in her role as instructor she can encourage

students to participate in an open classroom environment replete with communication and interpersonal relationships. Holly encourages the building of support communities between learners in her classroom.

Another aspect of Holly's role within the classroom is based upon her own experiences as a college student. She felt that, as a student, she needed more counseling, encouragement, and direction. To that end, Holly now tries to fill this void within her own students' experiences. Recounting a conversation she had with a student, Holly said:

> Well I have [a student] now, who started class this fall, (last year she took a full year of general chemistry) and was going to be a pharmacist. She didn't do great…I mean she could possibly have if she was real strong in biology. She could have stumbled through the chemistry and been OK. She came to take organic [chemistry], and I said, "How's it going? How were your classes this summer?" And she said, "Oh I quit going." Well she's decided not to be a pharmacist now…and she was beating herself up. She said, "I spent two years, I was going to do this and then I decided I didn't like it. So then I worked in a pharmacy for two years and I that's what I was going to do and now I decided I don't like that." And I said, "Stephanie, it's OK. I didn't know that I wanted to teach until I was 30." And I said to her, "You know, stick with this and we'll explore some things. We'll give you …we'll expose you to some other choices."

Clearly Holly extended a hand of support to a student that was having a difficult time "finding herself." She empathized with this student's experiences. Holly lamented that an instructor had not done the same for her:

> Who did that for us when we said, "I don't like this any more?" Who said, "You know, you can finish this degree…you don't have to be on the bench…you could go do this, or you could go do this!" Well, I didn't tell anybody I didn't like it until I just bailed out of the ship! I mean, I never went—before I was ready to jump ship—I never went and said, "I'm getting scared and I don't think this is what I want to do." I never called for help until I had already abandoned ship. I thought to myself, "I need to make sure not to let [her] fall." I need to make sure that I continue to tell Stephanie, "you know you could do this…you could do this…"

Based on a lack within her personal experiences, Holly is willing to provide support and counseling to students who indicate such a need. She believes that, without mentoring, students are treading without a life preserver in a "sink or swim" environment.

Liza, on the other hand, has not served as a faculty advisor nor does she personally counsel students. She had a difficult time recalling events where she may have provided anything but superficial guidance to her students. She could not locate herself in the role of being a mentor except through her experiences as a mother. Liza tells of her ethic about helping her children with homework:

> I'm not a very good teacher with my children. I very seldom help the children with homework. I always want them to find the answer to the question. And I saw so many kids—that's probably why [my children] didn't get the first prize on their projects—because I saw the projects from other kids, and it was the parents' project! And those kids [whose parents helped them] are failing now, because they have not learned to do it on their own. So I helped [my children] if they asked, but if they don't ask I back off. I just asked, "Did you do your

> homework?" It's called home-work. It means you are responsible for that work. If they need, and usually if they come to me and ask me for help, what I do is, I give them the books! So, [my daughter] asked for help. "You've got three genetics books right there. Find the information. Learn how to learn."

Liza works to develop her children's autonomy. She strives to instill a rooted sense of independence and self-direction in her son and daughter. She holds them accountable for their own learning.

> And I just get too frustrated with them! I don't have the patience with my own children that I have with my students, because I feel that my children should know that anyway. You know, if there are specific questions I will certainly help them. But if it's just like, "OK this is my homework, help me." I'm going "No, you try first, and then whatever you can't do then I will help." So, as I said, I am not a good teacher with my children. Or, let me put it this way, I did not support them in the way, in homework, that I see American parents [supporting their children].

In Liza's view, this type of support (as offered by American parents) is overprotective and indulgent. She withdraws from providing too much direction toward her children's homework. Liza attributed this parental stance to her European upbringing. She reflected on a dissimilarity she found between parents of elementary school children in Austria and those in the United States.

> I followed my European lead. It's a different society. Because I grew up, you know, [in Austria]. When I saw parents here hovering over their kids…it's probably one of the best examples…I could not believe that parents would

> actually go into the school with their kids. I was going, "Wait a minute!" And then they go in and have those "parents' days." That's unheard of in Austria.

Liza began to outline a major distinction between parental roles (toward children's education) in Austria compared to the United States:

> The cord is cut when you are in first grade. You do not complain to the teacher about the teachering. You might talk about it. But it's like the teacher is responsible for you during that day—school day—the parents are not being asked to "make sure that your children learn." That was the teacher and child's responsibility. That responsibility was not shifted to the parent for the child to learn. It's such a different structure. And my brother tells me now that they are shifting toward the American system.

When asked how she felt about the shift in the Austrian school system, Liza replied:

> I am terrified. I'm terrified. Because I think they're pampered. Which pampering isn't a bad thing, but the structure is not there. It's supposed to be the child's responsibility to take care of their work. So the task should be the result of their planning activities, so if the test results are not good that means that they didn't plan well, right? It's a different system.

Liza's narrative provides insight about her attitudes toward mentoring. In Liza's opinion, students are responsible for their own learning. She believes that outside intervention, in the form of mentoring or support, is overindulgent and essentially weakens students' abilities to proclaim themselves independent learners.

Liza's stance toward support communities is dissimilar from either Holly's or Anna's. Liza asserts that students need to be self-directed while Holly and Anna concur

that students need support in the form of mentoring. It is interesting to realize that, largely in part these differences exist due to our distinct societies' divergent perspectives toward education.

Community and personal support systems play a crucial role on the decision making process for women in the natural sciences as they choose careers within STEM fields. In the traditionally male organizations of STEM the way that women act and talk is different than the way that men act and talk therefore to the long-established men of the group women are difficult to read and understand. Difficulties in communication exist between groups. Women typically feel that they do not belong simply because they don't see anyone else in that environment that looks like they do.

Kronsell (2002) helps us to grasp the importance of the development of community and personal support systems for women choosing careers within STEM fields as she writes, "Although the male-as-norm is an abstract notion, it becomes real when everyday practices are carried out in different sites within institutions" (Kronsell, 2002, p.40). In the article Kronsell discussed the feeling of "homelessness" she and other women graduate students felt as they entered traditionally male dominated areas within higher learning. Further, she developed a discussion about "homesteading strategies" that these women created to help there be a more positive atmosphere for the women. "Because the seminar room had been such a traumatic experience for many of us, we developed an explicit strategy from the very beginning. Initially, it consisted of a kind of support group for all the women at the department. Later, the strategy developed into ways to gain knowledge and confidence through readings and discussions in a smaller setting" (Kronsell, 2002, p. 47). As these women met they were able to develop a sense

that the feeling of hegemony and marginalization was not just their own but that these were shared feelings among all of the women in the group. The support group that Kronsell discussed ultimately helped the women to achieve and complete their degrees through a supportive environment and the development of community.

One thing the women of my study have in common with Kronsell's experiences is that they both shared a lack of mentorship and community within their first graduate experiences. Oppositely, the women of my study did not have the benefit of such a large group of women from which they could share their experiences and create a supportive community within their graduate work institutions. Because of this lack and ultimately because of the lack of (male or female) mentors my respondents were each essentially forced to find their own way. There was no one to tell the respondents of this study about the structures of their departments or how things "really were". As Anna reflected upon her personal experiences with the lack of mentoring and community within her graduate experiences she articulates the overall consensus of the respondents:

> "I think it would have greatly affected my own career choice. I would have been less fearful of failing in the early years, and I would have been more open to alternatives. It is important to view these areas as real for "normal" women, not just for those who were somehow less feminine or who had given up part of themselves. I this it is extremely important, especially in those early years."

Differences in learning style preferences and relational strategies are clearly articulated throughout the narratives of this research. The respondents of this study suggest that personal support systems can influence how a woman views her decisions, benchmarks, and successes. They believe that the establishment of women mentors and role models is

an important component to the development of a welcoming picture for upcoming women within STEM fields.

Section Summary

Answers to the research questions that I posed contribute to the body of knowledge that we have about women community college faculty in the natural sciences. Through this research we find that these women make meaning of their academic and social experiences through their professional work as faculty at the community colleges. Further, we also come to understand that these women's experiences during postsecondary learning played a primary role as to their choices leading them to take a teaching position at the community college. Lastly we see the incredible importance of community and personal support systems for women within STEM fields.

Limitations and Reflections

Several limitations existed within this study. They include barriers to generalization, the spacing of interviews, and the geographic location of the respondents. However, through reflection we can articulate important strengths to this research as well.

Qualitative researchers generally study a single location or a small sample size of respondents. Certainly these techniques typically go against the statistical sampling strategies employed by quantitative research. To this end, qualitative researchers should avoid making distinct claims about generalizability (Maxwell, 2005, p. 255). Two types of generalizability should be discussed: internal and external generalizability. "Internal generalizability refers to the generalizability of a conclusion *within* [italics in original] the setting or group studied, while external generalizability refers to its generalizability

beyond that setting or group" (Maxwell, p. 115). Since my study focused specifically upon women community college faculty in the natural sciences, it should not be generalized to all women community college faculty members nor to all women faculty. The respondents in this research all lived and worked in the Midwest. Therefore this study should not be generalized to all women community college faculty in or out of the natural sciences across the nation.

In spite of these limitations, my research contains two unique strengths. First, I was familiar with community college faculty life through my own work as a natural science faculty member at a community college. I have worked at the same institution that my respondents were once employed; hence I knew them prior to interviewing them formally. In addition, because of our working-friendship we were able to physically move about and accommodate teaching schedules as necessary to conduct the interviews. We were always able to conduct the interviews in relaxed environments (mostly away from the campus) where the respondents were completely free to speak and elaborate. Through our strong rapport as friends and colleagues, we developed a mutual understanding of my research goals, my plans, and my intentions prior to the beginning of the formal interviews.

Second, my "insider status" as a colleague and friend allowed me greater access to issues that strongly affected my respondents. The respondents of this study were willing to share intimate details and difficult memories with me. They felt safe and were able to reveal their personal frustrations, buried anger, and professional challenges with me in a way that I do not believe a "non-friend" would achieve. Supporting me in this thinking, Marin and VanOss-Marin (1991) suggest that "same-ethnicity data collectors

should be employed in research projects where personal contact is involved" (p. 53). Specifically, they "can enhance rapport, [the] willingness to disclose, and the validity and reliability of the data provided" (Marin & VanOss-Marin, p. 53). In the gathering of the narrative data for this research, I had the same ethnicity, gender, natural science, and professional rank as the respondents; I view these commonalities as an enormous strength to this research. The participants in this study were very candid and forthcoming with their responses, and I strongly believe that being a member of both the community college faculty and the natural science faculty with my respondents enhanced and further validated the data collected.

Recommendations for Practice

The women's voices of this research project have provided two primary recommendations that will be useful for practice as we train and recruit more women into the historically male-dominated realms of science, technology, engineering and mathematics. Based on the narratives of the three respondents of this study we find that their recommendations will help future women within STEM fields to navigate, negotiate, comprehend and understand their own experiences. Further these recommendations would assist women as they make professional career choices within STEM fields.

Recommendation #1 – Acknowledge the importance of community

There is a large body of evidence that indicates within STEM academic environments women prefer a supportive social climate, have a greater interest in personal relationships, thrive on positive interactions with faculty members, and desire to be included within all classroom activities (Thompson, 2001; Beer & Darkenwald, 1989; Belenky, Clincher, Boldberger, & Tarule, 1986; Gilligan, 1982). These preferences all point to the vital importance of the woman's community in her success as she pursues a STEM career. The community of support that women have is instrumental to their success within science and mathematics. The community that women build can help to bolster their self-confidence as well as self-perception. This is a necessary component to successful achievement of academic credentials within STEM fields.

Within this community of support it is important to include professional counseling for women in postsecondary STEM areas. Without advice and direction as to professional paths they can follow, women can find that they end up with an advanced degree but no real job skill. Several times throughout the interview process Anna would lament, "What does a woman *do* with a degree in physics? She teaches." Having no one to guide and direct her into industrial arenas or commercial professionalism Anna felt that she had no choice except to teach. Since she did not earn the right to get a Ph.D. in physics, Anna was further "forced" to teach at either the high school or community college level.

The further development of community and mentoring relationships at community colleges and other institutions of higher learning will develop reciprocal benefits for students and faculty. Community college faculty that mentor find it fulfilling

both to themselves as well as to the areas they teach. Women can find it important that they contribute to the lives of women students following their lead. Community college faculty generally believe it is their responsibility to shape the lives of their students. Despite the challenges in the creation of an environment of sharing and mentorship, the evidence is overwhelming that this will be one of the reasons that teaching STEM fields at community colleges are valuable and worthwhile toward the growth of STEM students!

It is vitally important that intentional support is deliberately provided for women (and women students) within STEM fields. Through imaginative means such as forums, lunches, and informal meetings, women can support each other through their shared life experiences. Within the sharing, women find they are able to provide a valuable service for each other. This sense of community and support will reciprocate and benefit all invested parties.

Recommendation # 2 – "Feminist Studies" is more than a required course

Feminism and feminist studies have been around for a long time. However, in my own teaching experiences I have noticed that students continue to be blind toward gender issues that pervade the natural sciences. My students seem to be in denial that "something is wrong." Being content to sit among an overwhelmingly male classroom of students it does not occur to these students to question, "Where are all the women?" It must be made clear that gender inequities continue to disadvantage women within STEM fields.

As noted by Seymour (1995), "…in treating male and female students alike (e.g., impersonal classes, competing for grades, intimidating teaching style), faculty are, in effect, treating women in ways that are understood by the men, but not by the women," and in doing so, "faculty are unwittingly discouraging women more than men by the same behavior because women do not know why they are being treated in this way and do not know how to respond to it" (p. 461). Faculty within STEM fields frequently persist to employ aggressive teaching styles or manners not conducive to the learning styles preferred by women. If women students could *understand* these tactics and styles then perhaps they would be better suited to fare well within STEM fields.

Young women can come to understand that their personal preferences in relational-style and interactions are not indicators of academic success and excellence. Within the natural sciences interactions between faculty and students are often hierarchical and removed. Certainly women prefer a more interactive and collaborative style of interaction. Perhaps it is in the understanding that the combination of these styles (one driven by community the other being more distant and removed) can join together to provide a varied spectrum of ways-of-knowing within STEM fields. Consequently women might not as frequently abandon their STEM aspirations given this fundamental understanding.

If we could fully intertwine the notion of community with feminist awareness we would have two fundamental elements toward the development of positive change within STEM fields. Women need community; women need to understand feminism. Kronsell (2002) provides us with important words of experience from the field:

> Mentors may be very important in raising feminist consciousness and providing general support. This notwithstanding, it can also be discouraging to have it all told to you, i.e., that you are a victim of oppressing gender relations. In teaching I have experienced these drawbacks right in the classroom. When confronted with feminist ideas, theories, and literature, young women can be fiercely critical—reaching almost a point of denial. It is possible that the process of becoming aware of gender structures puts a damper on their dreams of future possibilities. (Kronsell, 2002, p. 52)

This brings us to understand that an advanced development of mentors, community, and feminist awareness is a delicate balance. The construction of strategies to address these needs must include professionals who have had common experiences of isolation, patriarchy, and hegemony with others in the group.

Gender is deeply embedded in the processes, procedures, voices, experiments, and cultures of STEM fields. To help students understand how well rooted (and tangled) these notions are we must insist that they are exposed to the fundamentals of feminism in order to expose the masculinism and marginalism of feminist values today. It is essential that we cause students to examine their unconscious (or conscious) resistance to these strange ideas; they must be taught to critically question norms, values, and beliefs specifically within STEM. As scholars these students will be able to pose new questions and bring new insights to areas deeply entrenched with patriarchal structures. Classrooms that help students to connect with their real life experiences will develop fertile ground and rich results in all areas of science, technology, engineering, and mathematics.

Much needs to be done. Change is most likely to occur if addressed by both individuals and institutions. When STEM disciplines fully address the challenges and issues discussed then we might be able to change the climate to one of gender equity, success, learning, and education within these areas. When the dominant discourse includes the voices, understandings, and lenses of *both* genders, then STEM fields will truly grow into a diverse and welcoming culture.

Recommendations for Future Research

In early January 2010, President Obama announced a partnership between federal agencies and public universities to train thousands more science and mathematics teachers annually, part of the federal administration's effort to make American students stronger and more competitive globally within STEM fields. According to an article by L. Nelson in *The Chronicle of Higher Education*, (1/6/2010) "Leaders of 121 public universities have pledged to increase the total number of science and math teachers they prepare every year to 10,000 by 2015, up from the 7,500 teachers who graduate annually now." Through a quick numbers crunching we see that these 121 public universities have pledged to, on average, graduate about 20 more STEM teachers per. This truly is not a huge influx of new STEM teachers into the national work-force, but it is a start. We should pause and consider where these students will be *likely* to take some of their first two year's of classes (especially the women students)? As Regents' institutions tuition continues to rise, students seek "value for their educational buck". They will likely start their STEM educational careers at a community college. Who will teach these students? Community college faculty within STEM fields will be their instructors. How important

is it that we study and understand the community college STEM faculty? Very important – community college STEM faculty are most likely to be the primary future mentors, leaders, influencers, guides, and role models for potential STEM students and upcoming teachers *at all levels of the educational spectrum*.

Community colleges are generally seen as the colleges of the community – the starting point – the affordable alternative within higher education. Enrollments at our nation's community colleges are on the steep increase. Universities are finding that partnerships with area community colleges provide vital remediation, preparation, and flexibility in the education of students' first two years of schooling. Sadly, the faculty at community colleges continue to be largely unresearched and understudied. I believe the "trick" to gaining more students within STEM fields is going to be when we truly start to examine and research the invisible STEM faculty that are likely to be the first-points-of-contact to these potential students. Research like the one I present in this dissertation is vital to a clearer understanding of practices, techniques, and models as we forge forward in our efforts to recruit and retain qualified faculty and students in STEM.

Although there are many possibilities for research endeavors to examine, I would like to suggest five main areas that future research should be focused and conducted:

1. Research on women community college faculty in general. Specifically it would advantageous to find out *why* they teach at a community college, the benefits they perceive of teaching at the community college, their preparation and training to teach at the community college, and their life experiences as faculty at the community college. It is *not* adequate and sufficient to research university women faculty and generalize that

data to community college women faculty. Further it would be beneficial to explore these women's progress into academic leadership positions at community colleges.

2. Research focused on women community college faculty within STEM fields. Specifically it would important to find out the barriers they have experienced within their professional careers so that suggestions can be made toward a more gender balanced STEM community. Research should be conducted on these women to find out about their teaching methodologies, their perceived professional identities, and their notions of community and mentoring. Exploring the roles that these women take in defining their scientific (and STEM) culture would be of great value. Finding out about the affect of the dual-role as a professional as well as primary child care giver would be beneficial to the body of knowledge we have on women.

3. Research on women students within STEM fields at our community colleges. As women transfer from the community college environment into the university environment we see a lot of "adjustments" to their career paths and majors. Smart women are leaving the community college only to find the university environment unwelcoming, unfamiliar, and unsuitable to their educational dreams. We don't want to lose these women in the "pipeline"! If more research was completed on women STEM community college students then perhaps we could better understand and address their needs, their communities, and their frustrations as they transfer. Further, it would be important to better understand the how the personal relationship between students and faculty contributes to the academic success of STEM students.

4. Research on attrition of women community college STEM faculty. As very little research has been completed on community college faculty, it is clear that a

better understanding of the attrition rates of STEM women faculty would be beneficial knowledge. This kind of research could uncover various causes, ties, discriminations, and issues of power that beget women to leave their important STEM teaching fields at the community college.

5. Research that results in improved professional linkages between university faculty and community college faculty is essential. It is important that we study what we could do, as professionals, to improve the condition of learning within both of our institutions. The teaching experiences of community college faculty should be explored and then linked to university faculty's research. Research could seek to better link the teaching expertise of one realm with the research expertise of another realm.

Together these five suggested future research areas combine as a good "starting point" for a more intense examination of community college faculty, community college students, and postsecondary experiences. Research that focuses on these five areas will bring a greater understanding to the future status and outlook of women within STEM fields.

Summary: Fairy Tale Lives

As I have poured over my respondents' narratives while writing this dissertation I was clearly stuck by the victories that my respondents had seen in their lives. Initially I wanted to make sure the world saw their victories as evidence that "See, you can do it too!" It has been a struggle to *not* write their lives with storybook endings. I wanted to portray them as victorious women, having weathered the hardships of life, standing strong through thick and thin. I wanted the reader to understand them as women—fragile yet strong, down but not destroyed, marginalized but in the center of life's text. I listened

to their stories and heard them narrate areas of struggle. I know the hearts of these women. Not only have I gathered data through my interviews but I had personal experiences for 5, 10, and even 20 years with these women. Ultimately upon reading and studying the transcripts of our interviews, something very disturbing was revealed. To the rest of the world these women *appear* to have storybook lives—they are White, mothers, middle class, college instructors, well-educated, self supporting, and established. The irony is that each of these areas is, in reality, a place to deconstruct the storybook *appearance* of their lives. In reality, there is no "happily ever after" that they seek. Rather, their lives have continuing chapters of struggle, acceptance, marginalization, hegemony, and patriarchal domination. Their lives are not constructed with fairy tale endings; instead their lives are constructed in new negotiations within their personal, societal, parental, professional and institutional lives.

As I write this conclusion I think about what impact a research project such as this might have on the body of knowledge in today's world. How does one measure such a thing? I can see many ways that this research needs to be expanded for future projects and many applications for the conclusions in this work. Sadly I also see an urgent need for information contained in this project to be distributed, discussed, and deliberated. *Today* (January 2010) my 16 year old daughter came home from high school excited to inform me as to the reason why there are so few women in the sciences and mathematics fields. I soon found that my daughter's high school psychology instructor informed his classes that the reason women do not succeed in math and science is because they do not have the same mental, logical, and calculating abilities as men. He claimed this information was 'scientific fact'. *He said these things out loud.* I am outraged yet

unsurprised. Gender bias is not behind us! Feminism must continue to inform, enlighten, and expose. Science must work to be inclusive and receptive to different ways of learning, reporting, and thinking. The battle continues.

This concluding chapter provided an analysis of the data where I shaped the chapter around discussions related to this study, implications for future research, recommendations developed and finally conclusions drawn from this research. I re-examined and discussed limitations of this study; and I offered a reflection on the research process. This study contributes to the scarce body of research available on the topic of women natural science community college faculty. It provides a qualitative glimpse into the lives of the three respondents in this study.

Notes

1. Goldberger, Tarule, Clinchy, and Belenky (1996) established a solid working definition for patriarchy. "Patriarchy is the structure and system where the value of women is obscured or diminished, and where women are devalued through gender-based inequalities in areas such as employment, education, and social activities. The inequities may be subtle…or blatant…but they all represent socially sanctioned methods of keeping women in a lesser position than men" (Goldberger et al., 1996, pp. 187-188).

2. What does one *do* with a master's degree in High Energy Particle Physics? Having not been trained in the nuances of industrial physics, and never having been afforded opportunity toward individual research, the master's student's future in physics is unclear. To stay associated with physics, however, there seems to be but one choice: teaching is the only option. This inevitable channeling toward the margin further excludes these students from science. "Few groups are more oppressed, more manipulated, more scorned, more scrutinized, more controlled, and more cursed at than classroom teachers" (Kottler, 1997, p. 53). "Oppressed", "manipulated", and "controlled" are key elements supporting science's dominant patriarchal power structure.

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