

**BEING A FEMALE ENGINEER:
IDENTITY CONSTRUCTION AND RESISTANCE OF
WOMEN IN ENGINEERING SCHOOLS**

A Dissertation

by

HYEJIN CHU

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2006

Major Subject: Sociology

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ABSTRACT

Being a Female Engineer:

Identity Construction and Resistance of Women in Engineering Schools.

(August 2006)

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Compared to other professions, women's representation in engineering professions is considerably lower than men's, and this particular *situated-ness* or *locality* makes women experience a unique process of identity construction. Using qualitative methods – two focus group meetings, nineteen autobiographical essays, and twenty two individual interviews, this research focuses on what women learn from their experiences in engineering school, and how they respond to their perceived experiences. This study proposes to delineate (a) the dynamic interaction between women and the social structure of engineering school; (b) women's perception and conceptualization of the social structure they practice; and (c) women's strategic responses to the structure leading to identity construction. Becoming an engineer is problematic for women because the identity of "engineer" is based upon hegemonic ideas developed by previous generations of engineers – men. This research explores how women, standing in the borderline of being women and

being engineers, account and construct their identities as women engineers. Sometimes women are subtly or not subtly coerced; sometimes they embrace dominant ideas; sometimes they creatively resist dominant approaches.

DEDICATION

To engineering women, who are still looking for their spaces embodying womanhood in masculine arenas;

*and for **you**, who are the nodes of my stories and the inspiring links to myself and the world.*

Thank you.

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CHAPTER I

INTRODUCTION

This is also a story of me, *Hyejin, Iris*, , yellow flat faced, dark eyed, and tiny Korean woman who arrived at the Easterwood airport in College Station, Texas in 1999 summer. Being located in a White male-dominated society, I have encountered the situations for speculating what it means to be a Korean *and* a woman. By reflecting on the self in this particular situation, I have constructed (and am still constructing) my conception of self in relation to others. Whenever I look at myself in the mirror, the fact of being different from others surfaces and causes me to question who and what I am. As check my hair and makeup, I check my attitude, language, thoughts, and even feelings to survive appropriately in this society. In the space where I see myself in the mirror, and at the moment when I confess to myself, I reflect upon myself who often conflict with each other. This study is a report of conflicting “(my)selves within one body.”

Compared to other professions, women’s representation in science-based professions is considerably lower than men’s. According to report based on the 2001 Current Population Survey (CPS) Data, one out of ten employed engineers is a woman, while two of ten employed engineering technologists and technicians are women. Women make up 17 percent of all industrial engineers, 12 percent of metallurgical/metal engineers, and 11.5 percent of chemical engineers. Among all other engineering

The style followed is that currently used in the *American Sociological Review*.

specialties – aerospace, mining, petroleum, nuclear, agricultural, civil, electrical or electronic, mechanical, marine, or naval architects – women represent fewer than 11 percent (U.S. Department of Labor Women’s Bureau, 2002).

It is, however, meaningful to observe that women’s participation in science-based professions has numerically increased, the labor market has become more open to women who have science, engineering, and technology degrees, and the working environment of those fields has continuously become better for women. Opportunities for advancement, high salaries, and equitable administration of work rules have been slightly but increasingly available for women (Haas and Perrucci, 1984; U.S. Department of Labor, 1982; U.S. Department of Labor, 1998; U.S. Department of Labor Women’s Bureau, 2002). Despite this promising progress, the most frequently raised question in research on women in science based professions is still “why are women underrepresented in science, technology and engineering fields?” This question addresses the structure and experience of the “leaky pipeline” which refers to the steady attrition of women preparing and/or occupying higher statuses in those fields (Haas and Perrucci, 1984; McIlwee and Robinson, 1992; Hanson, 1996; Eisenhart and Finkel, 1998; Seymour and Hewitt, 2000; Etzkowitz et al., 2000; Lederman and Bartsch, 2001; Wyer et al., 2001; Margolis and Fisher, 2002).

This study originates from the question about the rarity of women in science and technology-based professions, specifically engineering school, but it focuses on how women perceive and respond to the situation they encounter. What are the major reasons for the relative lack of women in the male-dominated professions? Is it

women's aptitude for building science-based careers (Lee, 1998), or is it the sexist working or studying environment which women encounter? Importantly, what happens to women during career selection, and how do they perceive it? How do women in science and technology-based professions define the situation in which they are involved, and what do they learn from their experiences? Through focusing on women's experiences in engineering school and their responses toward the organizational structure of the engineering school, this study proposes to delineate (a) the dynamic interaction between individuals (women) and the social structure of engineering school; (b) individuals' (women's) perception and conceptualization of the social structure they practice; (c) and individuals' (women's) strategic responses to the structure leading identity construction.

The rarity of women in particular professions, which are traditionally dominated by men, is often considered in terms of two major approaches – the socialization experience leading to gendered roles and the culture leading to gendered inequality. Through socialization processes, women develop certain attributions of identity, which are considered “feminine” by the society, and it influences women's behaviors, emotions, task performances, and career choices (Haas and Perrucci, 1984; Schiebinger, 1999; Etkowitz et al., 2000; Margolis and Fisher, 2002; Clewell and Ginorio, 2002; Correll, 2004). Gendered individuals, who are produced through socialization, reproduce gendered schemas positing women in disadvantaged positions (Kanter, 1993; Seymour and Hewitt, 1997; Valian, 2000). On the other hand, the socialization approaches can be criticized by the assumption that “gendered individuals enter gender-neutral sites,” thus

maintaining the invisibility of the “masculine organizational logic (Kimmel, 2000: 97-98),” and the limitation for explaining individuals’ effort to change the unequal practices. However, the approaches seeking the reason for women’s attrition in men-dominated areas from the “clash of two cultures” (Hubbard, 1984; Dryburgh, 1999; Schiebinger, 1999; Stonyer, 2001; Phipps, 2002) can also be criticized because they may overlook actual discriminative practices of the organization or blaming women for their lack of success in the masculine culture. This approach also focuses less on individuals’ strategic reactions or resistances to change the culture.

Thus, two different but closely connected approaches dominate research on the paucity of women in science-based fields. The gender difference in early socialization process and the masculine culture of the science and technology-based professions were suggested for explaining the “leaky pipeline” of those fields. However, those approaches focus less on the dynamic interaction between individuals (women) and the social structure. They focus less on the uniqueness of the situation women encounter, and they do not demonstrate how the situation can be constructed by various women’s voices. They do not explain substantially how women as individuals respond to the structure and their experiences within the structure. In other words, although there is research demonstrating how and why women leave or are coerced to leave the science-based fields, this same research does not considerably demonstrate how women perceive the stable structure of these fields, and how women react to the structure, except by leaving.

Women's *situated-ness* or *locality* should be considered to explicate the cultural conflict between being women in male-dominated places or positions, and how women perceive and react to the conflict. Women are situated or located in particular contexts and based upon their interactions have different perspectives about that context. Women engineers live in the boundary of two different worlds. One is the world of engineering ruled by men – it has been invented by fathers, and it has been built on father's rule. The other is the world of womanhood claimed by women that is different, perhaps even incompatible with that of men. Standing in the borderland of the two worlds, women in engineering follow the father's rule, but simultaneously violate his rule. This uniqueness of women's location allows researchers to see “not only the lives of the oppressed, but also the lives of their oppressors (Harding, 2004: 5).” Since “social reality is not external to she who experiences, makes, or observes it (Smith, 1990a: 53),” and since “people's lives or the view from a body” can be the condition of being heard to make rational knowledge claims (Haraway, 2004: 92), women's situated-ness or locality demonstrates not only the situation they encounter as outsiders, but also the social order ruling the situation as insiders.

It can also be argued that only examining the socialization and the structural explanations of women in science and technology-based areas does not specifically address the possibility of women to actively resist and build alternative identities that may allow them to successfully navigate these fields. Tonso (1999) found variations in engineering identities of male students but that women's cultural identities were limited and constrained – there are only a few identity terms defining women as engineers.

While Tonso considers identity to be important, she did not further explore how women were dealing with their cultural identities in this specific setting. However, in her research on women geeks in high school, Bucholtz (1996) suggests an argument for women's strategic identity construction. In her research, girls draw upon linguistic practices associated with nerdiness (e.g., sophisticated lexicon) to construct themselves as intelligent and academically successful. Bucholtz argues that it is through language and other social practices (voice pitch, clothes, pseudonyms, extra curricular activities, displaying intellectual ability) nerds construct alternative femininities and masculinities that critique normative gender identities (Bucholtz, 1996: 128). So, for girls, being nerdy is a strategy to subvert traditional feminine practices. Bucholtz's research about nerdy girls demonstrates how individuals break the assumptions of gender identity as fixed and dichotomous. Challenging the conventional assumptions that gender is "given," women are inferior in science, and femininity is incompatible with science-related fields, Bucholtz demonstrates how femininity in certain contexts is conceptualized by women in themselves, and the possibility of multi-dimensional and changeable femininities. Similarly, LeBlanc (1999) examines the ways punk girls resist traditional gender roles, and how they create identities by ignoring gendered cultural messages. Punk girls mock the ideas of beauty spreading in the teen girls' culture, and refuse to play the games of teenage femininity. By exploring punk girls' patterns of resistance to the traditional gender norms, and their tactics to deal with violence and harassment in the punk subculture, Leblanc illuminates punk girls' resistance to adversity,

their triumphs over tough challenges, and their work to create individual identities in a masculine world.

From the interviews and focus group meetings for my preliminary study and from the NSF Graduate Student Learning Community on the Culture of Engineering and Science, I too found that engineering students develop multidimensional identities. I learned that engineering students experienced a distinct and unique culture that powerfully influenced students to think, talk, work and behave. One of the engineers expressed this by saying that she even felt her brain was “formatted by engineering spirit (from NSF Graduate Students Learning Community Meeting in 2004 at the Texas A&M University).” Through living everyday lives and contacting others in engineering school, they learn how to think, work and behave like engineers. Consciously and subconsciously, they experience powerful cultural prescriptions about being engineers through engineering school culture.

The cultural prescriptions involved in learning to be an engineer do not weigh upon members equally. Seemingly neutral and value-free processes are not neutral or value-free because everyone does not have the same starting points. Even though students are supposed to go through the same program, and have the same professors, colleagues and class/lab equipment, individuals experience them differently. Some people have already acquired those cultural prescriptions before they enter engineering school, they are constantly encouraged to become engineers, and they launch themselves into the engineering world without a doubt of their identity.

Using social psychological claims about identity construction, this study presupposes that an identity is fluid, multi-dimensional, flexible, and shifting, and that individual identity construction processes are always interrupted by structural power relations. This research seeks to examine the attrition of women in engineering by investigating their struggles in *becoming engineers*. This becoming is controversial and problematic for some individuals in particular situations. The way engineering students construct an “engineering identity” is through hegemonic ideas developed by previous generations of engineers who were, of course, men. But the process of this construction is complex and sometimes contradictory. Sometimes women may be subtly or not subtly coerced; sometimes they embrace dominant ideas; sometimes they creatively resist dominant approaches.

Using Feminist Standpoint theories and adding qualitative method components, this study proposes to extend social psychological identity theories. Women’s situatedness or locality in engineering challenges women to continuously define and redefine their femininity. A particular cultural context, engineering school, makes women question their gender identity and rebuild it. This study illuminates the process of identity construction and reconstruction and details women’s multiple strategies.

CHAPTER II

RESEARCH BACKGROUND

This chapter examines the nature of identity and its operation within and outside of the self. Reviewing social psychological identity theories, literature of gendered organization, Giddens' Reflexivity, and Feminist Standpoint theories, this chapter explicates: (a) identity construction at an individual level and its structural significance; (b) the conflict or deflection individuals experience in the identity construction process; (c) the gendered context in which women are situated; (d) the importance of *situated-ness* or *locality* of women in particular contexts; and (e) resistance as the consequence of deflection, reflexivity and situated-ness.

2.1 Individual Identity Construction and Social Structure

How does an individual perceive self and what does the individual perceive as self? Is there a distance between 'self' and 'what the self perceives as self?' Symbolic interactionists have delineated the procedure of the development of the self concept. Symbolic interactionists evoke the significance of the relationship between the individual and the social structure by placing a stress upon the "social self." Mead differentiates 'me' from 'I' to explain the concept of social self and how self is constructed through interactions with others. As Dunn argues, in Mead's discussion of constructing the social self, the problems of meaning and behavior are located inside the concept of a social self, and the self is regarded as an agent of interpretation, definition, and action within a "relational matrix" or "sociality" (Dunn, 1997: 688).

For Cooley, the self is constituted through interaction with its surroundings and the self concept is not the separation between the empirical world and the mind. For both Mead and Cooley, self is not an a priori or pre-given since it develops only through contact with others. To understand the concept of social self, it is necessary to examine Cooley's "social knowledge" concept. Social knowledge is developed from contact with the minds of others, through communication, which creates a process of thought and sentiment similar to theirs and enables us to understand them by sharing their states of mind (Cooley, 1998: 111). We come to know about others and about ourselves by watching not only the interplay of action, but also that of thought and feeling. We are not, for the most part, reflectively aware of this (an insight of perceived movements), but we do it and the result is social knowledge. This process is stimulated and organized by language. We develop definite conceptions which we can pass on to others by aid of the common symbol (Cooley, 1998: 118). In other words, social knowledge is not only ideas or references to make sense of and interpret social events, but is also fundamental for understanding one's self.

In Cooley's argument, the concept of social self was advanced through what he called "the reflected" or "looking-glass self" (Cooley, 1998: 164). The looking-glass self demonstrates how one's self appears in a particular mind and the self-feeling one has is determined by the attitude toward other minds. In our imagination we perceive in another's mind some thought of our appearance (manners, deeds, etc.) and we are variously affected by it. The "imagined judgment" is evident from the fact that the

character and weight of that other, in whose mind we see ourselves, makes all the difference with our feeling (Cooley, 1998: 164).

Contemporary symbolic interactionists Stryker and Burke (2000) use the term identity with reference to parts of a self composed of the meanings that persons attach to the multiple roles they play (Stryker and Burke, 2000: 284). For Stryker and Burke, social structures outside given social networks act as boundaries or standards affecting the probability that persons will enter those networks. In other words, identities in social relations are evaluative, and individuals recognize possible identities based on what is socially desirable from the point of view of others. Again, for Stryker and Burke, identity is the consequence of interactions among individuals and between individuals and social structure.

Even though Stryker and Burke accept Mead's "self reflects society" dictum implying that the self is multifaceted, composed of interdependent and independent, mutually reinforcing and conflicting parts (Stryker and Burke, 2000: 285-286), they focus relatively more on stability of identity. In their argument, for the most part, only the hierarchy of identity salience, not identities themselves, change across time and situations. Stryker and Burke assert a link between identity salience and the social boundaries or standards internalized within individuals, and although they posit potential mechanisms of change, they do not depict how or when identities actually are defined and redefined by individuals, and they do not portray what exactly changes within an identity in the repetitive interaction with others.

An individual's identity construction process is based on the imagined or actual evaluations from others. Social knowledge, internalized norms, and social-cultural expectations of the social role operate as the imagined evaluations for individual identity construction. Individuals are always concerned with the socially desirable identity and normative expectations of them. However, at the same time, individuals have the ability to acknowledge the situation, and are able to develop strategies in favor of themselves. In these terms, identity and its construction are not only repetitive and persistent, but also active and situational. Goffman and West and Zimmerman demonstrate how gender identity is constructed through everyday performances and encounters with others. West and Zimmerman claim that gender identity is both a cultural and structural feature and an individually possessed quality, which is perpetually and repetitively produced because individuals are continually "doing gender (West and Zimmerman, 1987)." Individuals feel the pressure to perform their identity according to the internalized norms or other's expectation to obtain legitimacy, however, at the same time, ironically they have the possibility to perform and choose alternative identities. In various socio-historical contexts, individuals create, recreate, and maintain their identities by doing what they learn in the patterned social lives – social structure. So, identity can be fluid, situated, multidimensional, and interactive between individuals and the social structure.

The next section discusses the conflict between the acknowledged or internalized standards for identity construction and currently perceived self concept with introducing Affect Control Theory and social psychology of emotions.

2.2 Identity Contradiction, Deflection and Multiple Identities

Social constructionists conceptualize identity as an interactional accomplishment, and they see an identity as continually renegotiated via linguistic exchange and social performances. However, it can be argued that the constructive view of identity underemphasizes the essential role of power and tension in identity construction process. Affect Control Theory and the general field of the social psychology of emotions can effectively respond to that criticism by presenting the conflict and deflection between the subject and fundamentals, and demonstrating how power relations enter the individual's experience of identity construction.

As discussed earlier, Cooley's social knowledge is not only necessary to interpret social events, but is also fundamental for understanding one's self. When the social knowledge does not coincide with the perception of self, or when the social knowledge causes a rift and redefinition to one's identity construction process, individuals may redefine the self, the context or the relations with others. Affect Control Theory and the social psychology of emotions explicate this tension and its potential resolution.

2.2.1 Identity Construction and Stress

In Burke's theory (1991), identity is considered a consequence from the interaction between an individual and society, which constantly provides guiding standards. According to Burke, the identity construction process is the repetitive procedure of inputs, comparison and outputs. Through the process, a person encounters identity standards, fundamentals, commonly shared social knowledge or reflected appraisals, and compares his/her current reality to the identity standard. An identity

process is a “continuously operating, self-adjusting, feedback loop: individuals continually adjust behavior to keep their reflected appraisals congruent with their identity standards or reference” (Burke, 1991: 840).

Unfortunately, the identity construction process is not always a happy experience for individuals. Sometimes individuals experience difficulty or stress in certain situations. In Burke’s terminology, “social stress” arises when there is a discrepancy between a socially given identity standard and an individual’s current identity set. Burke demonstrates four conditions under which an individual experiences the stress: a) if the identity control process is broken by external events; b) if the perceived meanings cannot be brought into congruence with the identity standard; c) if one identity is maintained, then other identities must be interrupted; and d) the frequent adjustments of identity can interrupt other identities (more tight/rigid, more interruption/disruption).

In light of Burke’s theory, stress is a relationship between external conditions and the current state of the person. In other words, stress is produced when the current state of the person conflicts with external conditions. Some symbolic interaction theorists explain this conflict by demonstrating the power of agency and its ability to define a social situation. In social encounters, such “power is anchored directly in the surrounding macro-to-micro web of shared cultural meanings” (Stolte, Fine and Cook, 2001: 395). Power is located in the interpretations different actors have of negotiating the situational conflict. That is, “disagreements” may exist concerning who properly

should engage in negotiating with the situation, and how those individuals react (Stolte, Fine and Cook, 2001: 495).

2.2.2 Affect Control Theory

Heise and his colleagues (1995) developed Affect Control Theory which focuses on emotional stress emerging from the situation and calling into question appropriate identities. Heise claims that a defining situation is involved in locating appropriate identities for self and others at a given time and place. The labeling of identities for all actors in a situation, while not fixed and unchanging, yields a definition of the current situation. Different from Burke's identity theory which rests on the cognitive dimension of social meaning, Heise and his colleagues have studied social meanings in terms of their affective dimension. According to Affect Control Theory, standard dimensions of meaning that people maintain almost universally are evaluation (good or bad), potency (powerful or powerless), and activity. Further, almost any identity can be categorized as more or less good, powerful, and active. In fact, these categorizations create interval level values that allow comparison and evaluation over times. The initial values for a concept or an event are called the "fundamental sentiment" associated with the concept or the event: changes in the values due to different context or juxtaposition are called "transient impressions." For instance, as a profession, an engineer is viewed by people in terms of the socially maintained meanings--good, powerful and active. So if socially shared meanings of engineer are not consistent in certain situations, people feel uncomfortable and try to redefine the situation to obtain the consistency between the current situation and fundamental

meanings. The extent to which transient impressions differ from the original fundamental meanings is called a “deflection” (Robinson and Smith-Lovin, 1992: 14). In Affect Control Theory, it can be said that if the fundamental meaning of engineering is related to masculinity, women engineers will feel deflection. Thus, it is expected that women in engineering may seek for ways to qualify the elements of the situation (redefining the situation) so as to resolve the deflection and transform the experience into one in which there is some confirmation of fundamental sentiments. There are various ways in which this might occur. That is, the identity associated with engineer might change or identities associated with women might change.

Many social psychological studies support the basic argument of the Affect Control Theory. To resolve the deflection and removing fault from the widows and widowers, the counselor redefines circumstances (Francis, 1997); people select interaction partners in order to enhance their self image or maintain a stable view of self (Robinson and Smith-Lovin, 1992); medical students managed their personal emotion toward patients to be congruent with their professional doctor identity (Smith and Kleinman, 1989).

Smith and Kleinman’s study not only shows the emotional aspect of identity construction but also points out the political aspect of identity construction and maintenance. In their study, medical students put forth effort to manage their feelings to construct the higher status as doctor (compare to patients), to obtain “pride” and “self-respect,” and this management process is one of the important socialization practices in medical school (Smith and Kleinman, 1989: 63).

Haas and Shaffir (1987) also demonstrate how individuals, the neophytes, develop their professional identity as medical doctors. Medical school students experience the impression management process, including emotion control, to obtain desirable and legitimate status as a professional doctor. This individual impression management process is influenced by particular ideas of specific people because students are always evaluated by practitioners in higher positions. So, the impression management is critical for convincing “evaluators or gatekeepers of their competent trustworthiness (Haas and Shaffir, 1987: 63).” Through the professionalization process, medical school students or trainees learn cultural symbols (language, tools, clothing and demeanor) to identify/separate them (the bearer) from outsider (patients). It’s the process of obtaining authority, legitimacy, and status. Authoritative performances contribute to build successful image of professional doctor, and it is the symbolic-ideological “cloak” of competence (Haas and Shaffir, 1987: 55). Cloaking behaviors to deflect others from probing their ignorance is common but hidden in medical school. Haas and Shaffir do not examine considerably how all these professionalization processes are experienced differently by gender, but their research suggests that cultural symbols, symbolic interactions and behaviors may be related to certain characteristics. Objective, emotion-neutral, authoritative, and competitive (cloaking) behaviors or attitudes are traditionally considered masculine values.

In her study of flight attendants and their emotional labor, Hochschild (1983) points out the emotional dissonance individuals have when they interpret the situation in which they are involved. Her study of flight attendants focuses upon the control of one’s

feelings to project an image deemed appropriate and desirable. Hochschild delineates how workers try to preserve a sense of self by circumventing the feeling rules of work, how they limit their emotions to display “right” feeling and how they suffer from a sense of “emotive dissonance” (Hochschild, 1983: 90).

Similarly, Schleef (1997) explores how professional socialization in law school changes the perspectives of students, and how students redefine their professional identity. Comparing the “vocabularies of motive” uttered by students in different time sequence (Schleef, 1997: 623), Schleef found that students “relearn how to express their values and goals in order to conform to norms” within school cultures as well as within the wider profession (Schleef, 1997: 628). A number of law students, who talked about the strong social responsibility of law practitioners at the first interview, indicated that any sense of social responsibility they feel is not related to law at all, and they revised the meaning of social responsibility – it was now just for themselves, not for the work arena – by distancing personal life and profession. Through the professionalization process at law school, individuals redefine their thoughts of the profession in order to avoid the deflection between their initial motives of the social responsibility and current situation they encounter.

All these investigations delineate how an identity is constituted through the dynamics of internal aspects of self and the external cultural circumstances in which an individual encounter. An individual acts based on an identity standard including attitudes and emotions, and constructs his/her corresponding identity, but while constructing the identity, this individual sometimes experiences the social stress,

emotional dissonance, or ambivalent feelings in certain situations. However, in the social psychological approaches to identity construction, the situation which produces discrepancy between an individual's current reality and the socially expected standard is not usually focused upon critically. This study investigates this structural level by questioning whether a context, and why some particular contexts, might evoke emotional dissonance or conflict. Reviewing the studies about gendered organizations and discussing Feminist Standpoint theories, this study argues that the structure is often the genesis of stress. Before turning to the gendered organization studies and Feminist Standpoint theorist arguments of identity and its construction process, the next section explores the possibility of multiple identities in terms of the social psychological notion of deflection.

2.2.3 Deflection and Multiple Identities

According to Alexander and Lauderdale (1977), individuals sometimes confront a choice situation and constitute the situated identities that would result from their choice of each among several alternatives. Then, individuals decide what to do or what they expect another person to do, based upon their knowledge of themselves or others in terms of situated identity. All other things being equal, we predict that individuals will act to create the most socially desirable situated identity for themselves (Alexander and Lauderdale, 1977: 225-226). Situated identity theory predicts that normative expectations about conduct will emerge if the identity evaluations associated with choice alternatives are differentiated in terms of social desirability (Alexander and Lauderdale, 1977: 226).

While situated identity theory suggests identity change congruent to the social desirability, Howard (2000) describes individuals as active participants constructing identities through various types of interactions. Focusing on the inequality involved in the interaction with others, she argues that identities are “strategic” constructive products created through interaction, with social and material consequences.

While the social psychological approaches discussed earlier do not critically question the contexts per se where individuals feel the deflection, and the internalized standards, their significance is located in finding the various moments individuals experience the conflict between the self and the social structure. In the next section, by reviewing the literature about gendered contexts and by delineating Feminist Standpoint Theories, this research examines why and when individuals experience the deflection.

2.3 Women in Gendered Contexts

A variety of studies address the question, “why are there still so few women in science and technology-based professions?” There are two major approaches that seek the answer to this question – individually experienced socialization processes and the culture of science, technology-based professions.

2.3.1 Socialization Process and Gender Roles

Quite a bit of research focuses on socialization processes to explain gender differences in attrition and inequality in science and technology-based professions. To explain gender inequality, many social scientific studies suppose that gender identity evolves when boys and girls grow up in the gendered world. In this sense, the gender

identity of being a woman is defined as “inferior” to the dominant identity of being a man. This presupposition is broadly used for explaining gender inequality in professions.

Studies suggest that different socialization experiences influence different career interests, aspirations, and learning styles (Schiebinger, 1999; Etzkowitz et al., 2000; Margolis and Fisher, 2002; Clewell and Ginorio, 2002; Correll, 2004). Gendered socialization in a culture producing gendered expectations continues everywhere in science, engineering, and technology professions, and gendered expectations produce an ideology of women’s inferiority in particular sectors (Haas and Perrucci, 1984; Schiebinger, 1999; Etzkowitz et al., 2000). The literature on why there are so few women in science and technology-based fields has emphasized how different socio-cultural expectations for boys and girls lead to gender inequalities in education and professions traditionally reserved for men. Studies about hidden curriculum in higher education suggest that the covert gendered socialization and the hidden gendered curriculum in education produces forms of subordination, discrimination, and hegemony that benefit some at the expense of others (Margolis et al., 2001). Seymour and Hewitt (1997) point out how cultural assumptions of gender negatively affect women’s choices and lead to loss of confidence or high vulnerability to switching (changing science-related majors to others). Similarly, Valian (2000) argues that unequal opportunity in the professional work field is due to the cultural schemas and stereotypes on gender, and Correll (2004) also demonstrates that how cultural beliefs about gender on the professional career constrain individuals’ aspirations .

Even though some research asserts the on-going vicious cycle of production of gender inequality based on socialization, saying that women are socialized to perform feminine roles which are considered as less powerful and weak, and then their roles and statuses contribute to develop and reproduce gendered schemas, which posit women in disadvantaged position again, these socialization and sex role approaches limit understanding the interaction between individuals (women) and the social structure (the context women encounter) for constructing gender. As gender theorists criticize, these approaches assume that “gendered individuals enter gender neutral sites,” thus maintaining the invisibility of “gender-as-hierarchy (Kimmel, 2000: 97-98),” gender-as-institution (Connell, 1995), gender-as-performance (West and Zimmerman, 1987), and specifically the gendered organizational context (Acker, 1992). When gender is interpreted as the learned or developed nature, when it is argued that gendered individuals repetitively practice their roles, then, it is hard to find the moment or space individuals change or resist the social structure as they move through life and through different social situations.

2.3.2 The Culture of the Science and Technology-Based Professions

On the other hand, scholars also question the cultural environment of science-based professions, including school, and the work field. Research about the cultural environment of science and technology-based fields has multiple branches. Documenting the actual experiences of women, studies demonstrate what happens in male-dominant fields, and how they affect women’s attrition, advancement, and career development in those areas. These studies focus on how women work within schools,

organizations and professions traditionally reserved for men, and what difficulties women encounter when faced with rules, procedures and structures designed by (and for) men. These studies examine how structural facets of schools or work places may coerce women out of their career path.

Hubbard (1984) claims that women are less persistent in science and engineering because women's early socialization experience are incompatible with a cultural climate requiring hierarchical work structures and masculine working practices. The ways to achieve *viability* in engineering are not familiar to women students. Dryburgh (1999) examined the professionalization process in engineering, and found that women engineers work hard to show their solidarity with male colleagues and coworkers (even though recognizing some sexist remarks), and accept uncritically the masculine culture (Dryburgh, 1999: 676). Similarly, Phipps (2002) and Stonyer (2001) argue that, to be an effective member of the engineering community, members (students) must learn and take identities "compatible with the engineering" community (Stonyer, 2001: 393). However, the proven and legitimated engineering identities can exclude women. The ways to achieve success in engineering appear distant from the values women have learned and even incompatible with the concept of "woman." In her study on why women are so slow in advancing in science, engineering, and technology fields, Valian (2000) presents psychological studies about how gender schemas influence people's evaluation of others and how certain stereotypes and schemas are related to specific gender types. She found that certain characteristics or traits such as demonstrating competence or leadership were not compatible with the concept of women, and some

feminine traits were considered inferior or disadvantageous in specific jobs or positions. Similarly, Eagly, et al. (1992) conducted a meta-analysis on women and leadership and they found various moderating variables produced prejudice toward female leaders. For instance, women were more devalued than men when they were leading in a stereotypically masculine style, particularly if that style was directive and autocratic. In Meyerson (2003)'s 15-year study on business people, there were female leaders and executives in corporations who faced leadership difficulties. A so-called "feminine style of leadership" which is considered open and collaborative is often criticized by male colleague leaders because it is perceived to demonstrate "weakness." Women's sense of being a partial outsider (being a woman in predominantly male areas) tends to intensify, and women's gender identity becomes increasingly salient as a point of differentiation from their peers (Meyerson, 2003: 26). The more a woman advanced in the field, the more she felt different from her peers, and as Meyerson points out, she feels ambivalent for her situated-ness in the male-dominated position. This theme of ambivalence appears in Valian's report also.

Valian (2000) suggests that female leaders or executives in organizations felt ambivalent because their feminine qualities sometimes hurt their career and successful image but, at the same time, their successful qualities, such as assertiveness or aggression were considered negative for a woman. Additionally, according to Etzkowitz, Kemelgor and Uzzi (2000), if women do not have a sense of belonging to male-dominated fields, they experience low self-confidence, and question why they are there and what they are doing. Ambivalent feelings, low self-confidence and a sense of "not-

belonging” all lead to a cumulative experience of being an illegitimate interloper. Schiebinger (1999) points out that the psychological distress exemplified by ambivalent feeling, un-belongingness, isolation or confusion are due to the “clash of two cultures,” masculine and feminine. Quoting Evelyn Fox Keller, “science is masculine, not only in the person of its practitioners but in its ethos and substance,” Schiebinger argues that gender in the style of science is significant because women’s long legal exclusion from scientific institutions was buttressed by an elaborate coding of behaviors and activities as appropriately masculine or feminine (Schiebinger, 1999: 69). As examined in Schiebinger’s research, the notions about who is a scientist and what science is are associated with gender.

The perspectives of the “clash of two cultures” demonstrate how the macro culture affects individuals, and especially how women, as culturally marginalized members, confront the majority culture –masculine culture. However, these approaches may be criticized by bringing up the essentialist argument of gender. In their arguments, it seems there is a clear boundary between masculinity and femininity. In other words, these approaches assume that women have feminine values or qualities, which are not viable in masculine world, and at the opposite side, there are men who have the viability to succeed in their fields.

Thus, referring to the criticism about the socialization-sex role approaches and the culture of professions research, it is necessary to explore the dynamics between individuals and the organizational context by examining how the organizational context is gendered and how women react toward it.

2.3.3 The Gendered Context Women Confront

Studies have explored what women experience in historically male-dominant occupations, and how such occupations are organized by particular rules, which are invented and maintained by men (Kanter, 1993; Reskin, 1993; Acker, 1990; Haas and Shaffir, 1987; Lorber, 1984; Pierce, 1995). In gendered contexts, gender – being women or men – means not simply “difference” which are biologically sorted, separated, and socialized into equivalent sex roles, but also the “inequality” between women and men, which is addressing power and hierarchy (Kimmel, 2000: 1). Women are traditionally assigned to the less powerful or the subordinate positions because it is believed that women have those characteristics. Women have traditionally been considered weak and not suitable as leaders. But there are studies addressing that it is not gender difference per se, but the positions women usually occupy in gendered society.

Experimenting in simulated organizational settings, Johnson (1994) studied conversational patterns in different types of organizational groups, and found that formal authority is more important than gender in understanding conversation patterns, supporting the situation/authority explanation. Regardless of sex, subordinates exhibit “more supportive and less directive” in their speech than formal leaders (Johnson, 1994: 133). In her discussion of power and leadership, Kanter also claims that “power wipes out sex” (Kanter, 1993: 200). This means that women in the subordinate positions are considered weak or powerless not because of sex but because of status in the hierarchical order of the corporation. Some organizational positions, which are usually occupied by

women, carry such weak, less powerful, and subordinate images, and this reproduces the cultural schemas about genders repetitively.

Acker maintains that the inequality between men and women is reproduced and legitimated through the experiences in the workplace. According to Acker (1990), in the workplace the tasks and positions are divided based on gender, and everyday interactions corresponding to the tasks or positions are also organized in gendered ways. Moreover, general presentation of self demanded in positions, such as facial expression, dressing, or talking styles, correspond to the culturally demanded gender roles. Thus, both Kanter and Acker focus upon how gendered hierarchy reproduces.

In her study of the medical profession, Judith Lorber (1984) emphasizes how gender discrimination is deeply embedded in the social structure of medicine and how gender inequality is reproduced through the professionalization process. So for example, she examines what aspects of the medical profession have kept women physicians from the top practitioner positions or segregated in particular domains of medicine. For instance, surgeons are supposed to be aggressive and unemotional, while pediatricians emotionally sensitive. So, the fields most frequently recommended for women are pediatrics, psychiatry, and anesthesiology (Lorber, 1984: 32). Furthermore, women and men medical trainees experience professionalization differently. In medical training processes, men usually obtain a sponsor, who provides concrete and direct advice, whereas women usually had abstract or indirect role models.

Crediting Hochschild and Chodorow, Pierce (1995) explores how gender is produced and/or reproduced in corporate law firms and legal departments. Pierce argues

that socialization is not a one-way process. Instead of simply conforming to a predetermined set of roles and attitudes, individuals bring their own interests and identities to bear upon social interaction, often redefining them in process (Pierce, 1995: 11). Women paralegals and lawyer secretaries were encouraged to perform emotional tasks such as, being nice, nurturing, and personalizing work relationships, while men paralegals distanced themselves from being nice by expressing contempt. Male paralegals choose to exclude themselves from women's social activities and express contempt for their "nicey-nice" female counterparts (Pierce, 1995: 157). So, gender identity is confirmed and reconfirmed through emotional labors of paralegals. In her study, Pierce demonstrates that while women workers resisted degradation on the job, their strategies were clearly gendered because they sought the significance of their work by emphasizing relationships among people.

All these studies illustrate the interactive and situational context of gendered inequality. However, to understand why women's situation is unique and why women's experiences can provide a "better" view of the gendered structural context, it is necessary to consider Feminist Standpoint perspectives about women's *situated-ness* or *locality*.

2.4 The Locality of Women and Feminist Standpoint Approaches

To understand the cultural conflict, stressful tension or deflection of being women in male-dominated professions, women's *situated-ness* or *locality* should be considered. Women in engineering experience conflict, tension, or deflection because they are positioned or located in particular place, which continuously challenges woman

to define and redefine the situation and herself. Feminist Standpoint approaches emphasize the importance of the positioning or locality of individual, especially woman. Furthermore, they delineate the social order in the web of positioning. So, to explore these individual experiences, in the Feminist Standpoint research inquiry, an individual (woman)'s biographical narratives become the research subject.

Feminist Standpoint epistemologies and methodologies have developed to focus on “the resources for the production of knowledge” in women’s lives (Harding, 1998: 149). These perspectives challenge the conventional view that scientific knowledge is objective, value-free, disinterested, and situationally transcendent. Questioning objectivity and measuring knowledge in terms of particular social locations and experiences, Feminist Standpoint perspectives give attention to the relations between the production of knowledge at a specific location and practices of power (Smith, 1990a; Smith, 1990b; Harding, 1998; Haraway, [1991] 2004). As Hartsock puts the point, a standpoint is not simply an interested position (bias) but is interested in the sense of “being engaged,” and a standpoint is a political struggle to see “beneath the surface of the social relations in which all are forced to participate (Hartsock, 2004: 36-37).” This means that individually experienced social relations and statuses, such as class, race, or gender in a society where power is organized hierarchically, should be considered significant resources to produce knowledge in a particular location/situation/position.

In her essay about “situated knowledge,” Haraway also argues for politics and epistemologies of location, positioning, and situating, where “partiality” is the condition of being heard to make rational knowledge claims (Haraway, [1991] 2004: 92). In her

discussion, the partiality, as a condition of objective knowledge, is developed to be the “vantage points of the subjugated.” “Subjugated” standpoints allow demonstrating more adequate, sustained, and transforming accounts of the world (Haraway, [1991] 2004: 88). The subjugated, do not freely choose their standpoints. Standpoints are given to the individuals and must be considered at their own locations. In other words, individuals have standpoints at the specific location to make themselves accountable to others or communicable to others, and to do this, they need to learn the rules. For the oppressed, learning the rules and adjusting the self to the system are crucial: whereas the privileged have been advantaged by the rules and consequently have routinely lived by them. However, this does not necessarily mean the cancellation of the subject or disappearance of the self into the system. As Haraway asserts, it can be called “the opening of non-isomorphic subjects, agents, and territories of stories” at the various locations (Haraway, [1991] 2004: 90).

Haraway and other feminist standpoint theorists emphasize how women’s diverse and different lives can provide the starting point for asking new, critical questions about not only those lives, but also about men’s lives and the social institutions designed by men. Questioning the “causal relations” between women’s lives and men’s lives, and social institutions (Harding, 1998: 152), Feminist Standpoint perspectives locate women’s biographical stories in the center of the research. Culturally and politically assigned women and their standpoints, as suggested by Smith (1990a, 1990b, 1999), provide a site for women’s experiences and biographical stories, and consequently an exploration of the social order.

Feminist Standpoint theorists deny the essentialist argument of a given, stable, and unified identity (as do the social psychological theories mentioned earlier). But they also do not claim the “death of the subject,” as do some structuralist approaches. By asserting the uniqueness of the subjective locality or situated-ness, Feminist Standpoint perspectives shed light on the possible resistances or various identity construction strategies at one’s position. The concept of subjective locality and its significance can be discussed further with Giddens’ “reflexivity” and the emergence of “the social” in Dorothy Smith’s arguments.

2.5 The Emergence of Resistance and Multiple Strategies

Women’s situated experience, their *situated-ness* or *locality* leads to constructing knowledge about the self relating the situation. Particular ideas of their (women’) identities are produced corresponding to the specific manifestations of power or patriarchal rules within any given culture. Women are defined and interpreted by others around them who have the legitimated authority for accounting them. This means that women’ identities and femininities are constructed not only by themselves but also by others corresponding to the particular notions invented and developed by the vantage group, men.

Women have often resisted the dominant account about them and the traditionally assigned roles to them. However, discussing women’s resistance usually focuses on collective or organized movements, not individual women’s resistance. It is important to examine individual resistance and how such resistance emerges, so that we can better understand different levels of resistance and how these levels might interact.

Expressing the mutual dependence of social structure and agency, Giddens argues that “social structure is produced and reproduced in what people do (Giddens and Pierson, 1998: 77).” The social structure invisibly exists or is formed in people’s day-to-day use of it, and it becomes real in the consequences of recurrent individual interactions. Whilst individuals’ everyday interactions in traditional societies were based on clearly defined expectations and roles, in the modern age individuals have to develop roles for themselves. The shift from the traditional to the modern era gives individuals a space and time for reflecting on who they are and what they do to interact with other individuals. This chance for reflexivity is viewed as particularly important for the modern self. For Giddens, individuals, who live in the modern world, experience the process of monitoring, questioning and speculating about the behavior of the self and others within the particular social conditions. Modern individuals give reflected feedbacks to their own actions responding to the relations with others. Inquiring into self (the self-identity) is explicating the relations between the personal and the social. In terms of this, individual reflecting process is “institutional” because it is a “basic structuring element of social activity in modern settings (Giddens, 1992: 28).”

Giddens credits Foucault’s exploration of the modern power and the subject. Foucault argues that the modern power exerts through self-disciplining mechanisms of surveillance. Attentive and curious individuals come to understand the relations with others through constant observation and examination of the self (Foucault, [1978] 1990; Foucault, [1977] 1995). So, having confessions and uttering narratives about the self are the moment or the space when/where the individual (the subject) meets the self.

Psychoanalysis and psychiatry invade the moment or the space with knowledge, and the knowledgeable power disciplines the individuals' emotion, desire, behavior about the self. In spite of his preeminent exploration about the modern self and its relations with structural power, Giddens criticizes Foucault portrayal as a "one-way" intrusion of power-knowledge into social organization (Giddens, 1992: 28). In Foucault's discussion, by disciplining the bodies corresponding to the scientific knowledge about appropriate relations, the subjects have been *absorbed into the structural web of relations of others*. This means that modern subjects are disciplined to make socially acceptable relationships – relations in the moral, sexual, educational, religious, and other domains. The disciplined subjects achieve significant meanings only for maintaining the relations with other members of society.

Different from Foucault, Giddens posits self-understanding and autonomy of action to the self monitoring or self examination process of the modern individuals. Associating self-identity with personal autonomy, Giddens asserts that the process of reflexivity opens many "emancipatory" politics and "autonomous development" of the modern individuals (Giddens, 1992: 64). For Giddens, the development of reflexive attention entails the recognition of choice – the way to access life style opportunities. The creative construction of lifestyle becomes feasible through diverse ways – political resistance, distinctive cultural life style, or social movement. The reflexive shaping of self-identity is constituted in the exploration of different opportunities in everyday life.

While Giddens seeks to examine the reflexive modern self and its emancipatory possibility, Dorothy Smith explores the socially and culturally assigned condition of the

individual for a particular emancipatory possibility, resistance. Claiming “the social” at “the actual local site of the body,” Smith argues that the sociological inquiry should start with the social agent who is actually (physically) located in the web of social relations (Smith, 1999: 4).

“The knowing subject” is always located in a particular spatial and temporal site, and sociological inquiry explicates what s/he does not know – “the social relations and organization pervading her or his world but invisible in it (Smith, 1999: 5).” Giddens is not satisfied with G. H. Mead’s I/me/you (the generalized others) relation because ‘I,’ the unsocialized subjectivity, is not successfully founded for the emergence of self-awareness or reflexivity (Giddens, 1991). But Smith more focuses on how the social emerges in the three-way relations of I/you/me. Referring to Mead’s view of the object constituted in the social act, not external to the individuals, Smith finds practices of referring to objects as moments in a social act by observing the self and others. “Referring is a concerting of consciousnesses through symbolic interaction” (Smith, 1999: 115), and for an individual, referring is significant to make the self accountable to others and also to the self because referring is always based on “the social grammar” (Smith, 1999: 117). Thus, Smith asserts that in the three-way relation, not just subject-object, but subject-object-subject, the social agent achieves its social significance or actually exists relating with always “implicitly present” others (Smith, 1999: 117).

For Smith, the spatial uniqueness of the agent gives her/him the space of resistance. This is the place or the moment, in which the subject is situated or located; “I” and “me” meet (Mead); the subject looks at the self in the “looking-glass” (Cooley);

the subject feels deflection (ACT); the subject confesses to the psychiatrist (Foucault); the subject speculates or reflects on the self (Giddens); the “situated knowledge” is produced (Haraway); “the social” emerges (Smith); the subject defines and redefines the situation s/he encounters; and the resistance emerges.

Women in engineering schools are situated and located in a particular context. They have learned cultural expectations about women through the socialization process, and they have also learned what is expected for an engineer through encountering events in engineering schools. They acknowledge the rules and regulations for being an engineer, but they sometimes want to violate the rules invented and maintained by the dominant members of engineering schools, men. Women in engineering volunteer to follow the rules to be an engineer, but simultaneously they seek to find the chances to be different from the expected engineers. Their *situated-ness* or *locality* triggers the opportunities to reflect upon the self as a woman and as an engineer, and the *situated-ness* or *locality* can lead to resistance.

CHAPTER III

METHODS AND RESEARCH DESIGN

3.1 Methodology

The previous chapter reviewed literatures discussing how social order and power relations are produced and reproduced through individuals' experiences in particular contexts. Women engineering students have distinct experiences in engineering schools because they are situated in the particular context continuously challenging their femininity. To investigate these experiences, different methods are used. Focus group meetings, surveys, essays of self (writing autobiography), and in-depth interviews were designed to explore how individuals in engineering school understood what engineering is, what they experienced in engineering programs, and what they felt as engineering practitioners from diverse backgrounds.

3.2 Focus Group Meetings

Two focus group meetings were held in the Fall semester of 2004 as a preliminary study. As a qualitative method, focus groups allow participants to discuss a topic of mutual interest to themselves and the researcher (Morgan and Spanish, 1984). The major advantage of focus groups is that they offer the chance to observe participants engaging in a specific interaction that is concentrated on specific attitudes and experiences of interest of the researcher (Morgan and Spanish, 1984: 259). Thus, focus group meetings reveal how participants discuss particular issues among themselves and

how participants respond to other participants' interpretations or attitudes toward the topics.

Through the focus group meetings, I investigated the particular images of engineers; ideas or thoughts of what constituted an engineer; any constraints for success for being a woman engineer; and experiences in engineering school as woman.

To identify potential participants for the focus group meetings, I contacted engineering professors who were involved in the Women In Science and Engineering and the Women in Engineering, Science and Technology at the university, and through forwarding my email or individual conversation, they introduced this study to some women engineering students. Participants were first contacted by email, and then were scheduled through the phone or email individually. Those who volunteered to participate received \$20.00 for their time.

When the participants contacted me for participation, I asked them for available times for the group meetings, and then two groups were organized with three to four participants based on their availability for the meeting schedules. One group was composed of three Black female engineering undergraduate students and one White female engineering graduate student, and the other group was composed three women: one Black undergraduate, one White graduate and one Black graduate student in the engineering school.

Upon arriving at the seminar room, each participant was introduced to each other, but this part was not recorded to preserve confidentiality. Each participant read and signed the informed consent form (see the appendix). To describe the topic of the study,

the statistics of female enrollment rate in the engineering programs collected by the Engineering Academic Programs Office were presented (<http://eapo.tamu.edu/pdf/engr-w.pdf>). According to the Engineering Academic Programs Office at the university, in Fall 2004, 19.8 percent of registered students including undergraduates and graduates were majoring in engineering programs (8,808 out of 44,521), and 18.4 percent of them were women students (1,622 out of 8,808). 273 engineering students had completed a survey during the Fall semester 2004, and 86, or about 31.5 percent of the all respondents were women.

In the university, about 10 percent of all registered engineering students are minorities composed of 77 percent of Hispanics, 20.8 percent of Blacks and 2.2 percent of Native Americans. In this research, 86, about 31.5 percent of the respondents were minorities and there were 12.5 percent of Hispanics and 9.5 percent of Blacks. 26 were minority women and it was 30.2 percent of all female respondents.

The students enrolled were graduates (9, 3.3 percent), seniors (71, 26 percent), juniors (93, 34 percent), sophomores (67, 24.5 percent) and freshmen (33, 12.1 percent).

The questions about women's experiences in engineering programs were provided by the researcher (see the appendix), and the participants were asked to discuss their thoughts focusing on the questions. The meetings took the form of group discussion and the participants shared their stories, experiences, thoughts and feelings with other participants freely. The meetings ran about two hours, and the taped data was transcribed by the researcher with help from an undergraduate research assistant.

3.3 Survey

After reviewing the information from the focus groups, I conducted a survey in the Spring semester of 2005. The survey was designed to examine general experiences in engineering school, and to explore what engineering students thought about the images of engineers. The survey questionnaire focused on how engineering students understood and worked with the notion of “being an engineer,” and specifically how women engineering students experienced different paths to structuring an engineering identity in an academic training program (see appendix). The survey questionnaire was composed of twelve items asking what engineering students thought of their engineering majors, department climates, professors, and the images of engineers. Questionnaires concerned why they chose engineering as a major; what attractive things students anticipated from their majors; what images of engineers they had, such as active, productive, competitive, geek, studious, rich, etc.; and what impressions they had for their majors, such as helpful, enjoy, bitter, hurting, competitive, challenging, etc. The questionnaire also included some semantic differential items from Affect Control Theory (Heise and Calhan, 1995). Affect Control Theory posits that almost all terms can be evaluated in three dimensions--evaluation (good/bad), potency (power/powerless) and activity (active/inactive). So the survey could examine the EPAs (evaluation, potency, and activity) of engineers and other statuses in society. In this survey, respondents were asked to express their emotional EPA toward certain objects--man, kindergarten teachers, nurses, and engineers.

For the survey, the professors who were involved in the Women In Science and Engineering and the Women in Engineering, Science and Technology at the university were contacted for the survey research. Some professors introduced this study to their colleagues in the department who were teaching undergraduate required courses and upper level major courses.

The researcher was invited by the professors to the engineering classes to conduct the survey. The questionnaires were distributed right after the class or before the class (whichever the particular professor requested). Students volunteered to answer the questionnaires and they were collected on the spot.

Additionally three different engineering student organizations for women engineering students, for the Black engineering students, and for the Hispanic engineering students were contacted. The researcher was invited by the president of each association to visit their meetings to distribute the survey. The organization members volunteered to fill in the survey questionnaires at the end of the meetings, and the survey questionnaires were collected on the spot. Some participants voluntarily signed up for the follow up studies-autobiographical essay and individual interviews.

3.4 Autobiographical Essays and Interviews

To delineate the identity construction process at the individual level in the particular cultural context, I adopted two qualitative methods – autobiographical essay writing and in-depth interview. Following the reasoning of Dorothy Smith, conventional social scientific research for exploring macro-social relations have excluded the presence of subjects and displaced the connection between analyzed relations and the actual

people's lives and experiences (Smith, 1990a). Harding and other feminist standpoint theorists also point out that by listening to women and other oppressed groups, it is possible to illuminate knowledge claims not only about themselves but also the rest of social relations (Harding, 2000; Harding, 2004). As feminist standpoint theorists suggest, autobiographical stories and individual narratives demonstrate how insiders of the social structure reflect and conceptualize the realities they experience in their own words; how the oppressed groups actively participate in the process of constructing realities by reflecting and conceptualizing them; and consequently how the standpoint of women's experience can be a method of discovering the social.

The autobiographical essays and individual in-depth interviews were designed to investigate how individuals explain their engineering major choice, how they interpreted their experiences in engineering school, and what they thought of themselves as an engineer (see appendix). The study participants were asked to write about themselves as an engineering student -- how they decided to study engineering, what influenced them to choose engineering, and what they think of themselves as future engineer.

3.4.1 Autobiographical Essays

From the pool of survey participants, I contacted the students, both men and women undergraduates and graduates of the engineering school, who signed up for the further studies by email. They received the information letter (see the appendix) about the essay and were asked to write an essay about how they thought of themselves as engineers. Below is an excerpt from the information letter:

So, you can write what you want to say about your experiences, feelings, and thoughts about engineering school, engineering program and becoming an

engineer. You can organize this however you wish, but it is probably best to pick three or four times to think about your program and how you are or are not changed by your experiences. You might think about answering the questions: How have I become an engineer?; What shaped that decision?; How have I been surprised (or not surprised)?; and How do I think others see me (in the engineering society)?

In the Spring semester of 2005, four male and fifteen female undergraduate engineering students volunteered to write the autobiographical essay and sent their essays to the researcher via email. I included both male and female undergraduate engineering students to explore if there was gender difference for accounting their experiences in engineering school and engineering identities. Three White male and one American Indian male engineering student wrote the autobiographical essays. Out of fifteen female participants, there were eight Whites, three Asians, three Blacks, and one Hispanic female undergraduate engineering student.

The participants received \$20.00 for their writing when they visited the researcher to sign the informed consent form (see the appendix).

3.4.2 Individual In-Depth Interviews

Among women participants of the autobiographical essay writing, fourteen of them volunteered to be interviewed in May 2005. Eight more participants were interviewed, and they were identified from others who had participated through the NSF Graduate Student Learning Community for the Science and Engineering Students at the university.

Table 1 shows the list of the interview participants:

Table 1. List of Interview Participants

PSEUDONYMES	CLASSIFICATION	MAJOR	RACE/ETHNICITY
Bunny	junior	Petroleum Eng.	White/Anglo American
Bela	junior	Petroleum Eng.	Black/African American
Debra	senior	Electrical eng.	Black/African American
Diana	senior	Civil eng.	Asian American
Emma	Ph.D. student	Civil eng.	Hispanic/Mexico
Bettie	junior	Petroleum Eng.	White/Anglo American
Eli	Ph.D. student	Civil eng.	White/Anglo American
Gwen	Master student	Chemical eng.	Black/African American
Jill	Master student	Mechanical Eng.	Black/African American
Julia	senior	Civil eng.	White/Anglo American
Judy	senior	Agricultural eng.	White/Anglo American
Kim	Master student	Industrial eng.	Black/African American
Kelly	senior	Mechanical Eng.	White/Anglo American
Maali	Ph.D. student	Chemical eng.	Black/African American
Messina	junior	Civil eng.	Black/Caribbean
Mia	senior	Mechanical Eng.	Black/Jameica
Mandy	sophomore	Electrical eng.	White/Anglo American
May	junior	Electrical eng.	White/Anglo American
Meg	sophomore	Electrical eng.	Asian/China
Nikky	sophomore/junior (by credit hours)	Aerospace eng.	Hispanic
Teri	Ph.D. student	Nuclear eng.	White/Anglo American
Zena	junior	Petroleum Eng.	Asian/Kazakhstan

Out of twenty two interview participants, thirteen were minority students, and seven were graduate students. The participants received the information letter (see the appendix) from the researcher by email and they were scheduled through the phone or email. The individual interviews were held in the social psychological laboratory of the Academic building at the university. They usually ran about one and a half or two hours, and the participants received \$20.00 for their time. When the interview participant came to the place for the interview, they received the informed consent form (see the appendix) and had time to read it and sign it. The participants could select if they were to be audio-taped or video-taped or both. Four interviewees did not want to be video-taped, so their interviews were only audio-taped. Other interviews were recorded by a video camera and an audio recorder at the same time. The interview participants answered questions about how they decided to become an engineer; their images of successful engineers; general experiences in the engineering school; their thoughts about successful women engineers and women engineering students; how they thought of themselves as engineers; difficulties for succeeding in the engineering school as women; and their survival strategies in the engineering school.

All of these interviews were transcribed, and another researcher randomly chose and read interview transcripts for increasing the validity of the research. I searched for overarching themes in these interviews, but also examined the sequence of narrative, the narrative style and the use of particular words and plots.

Themes were identified by the patterns in the way respondents discussed questions. If a particular term, question, or issue was commonly repeated, it was

identified as important to analyze (Riessman, 1993). Examining how specific words were used or placed in accounts, I investigated how informants experienced their surroundings and how they organized their experiences in their accounts. Referring to the larger context, and by scrutinizing the relationship among words, the order of narrative, and the larger context, I reconstructed and interpreted the narratives. This also means that I identified underlying propositions that make the informants' talk sensible (Orbuch, 1997), and I investigated how informants tried to make their talk sensible by sometimes accepting contradictions or by sometimes seeking consistency.

Social psychological theories and Feminist standpoint theories were used for analyzing the narratives. Their theoretical concepts provided instruments for disentangling sociological themes from the narratives.

Based on these methods, this research was organized three major themes – “Doing Engineering,” “I Am a Woman in Engineering,” and “Challenging Engineering.” The first theme illustrated perspectives about the field of engineering and engineers. In the chapters of this theme, I focused on how engineering and the engineer identity were constructed through engineering students' experiences and narratives. The survey data about general experiences in the engineering school, and images of engineers in the autobiographical essays and interviews are considered. The survey results reflect some similarities among men and women's experiences and some differences. Autobiographical essays and interviews detailed especially prominent recognition about what it means to be an engineer, competition and competitive learning environments; and underlying assumptions about engineers that lead to conflict for engineering women.

The second theme illustrated women's *situated-ness* or *locality* in the engineering school. Survey results showed that women were more likely to consider leaving the engineering school. Based on this result, autobiographical essays and interviews were examined for particular contexts or interactions that may lead women toward thinking about leaving. Autobiographical essays and interview narratives demonstrated the conflict between what women's social situated-ness and their locality in engineering. Interview narratives detail how women experience this conflict through everyday practices such as studying, working in groups, and interacting with other engineering students and professors.

The third theme illustrated women's responses and reactions to the conflict they experienced in engineering. Interview narratives provided information that how women engineering students reacted toward their experiences in the engineering school and used different strategies to challenge the dominant perspectives of engineering.

CHAPTER IV

RESULTS

4.1 Theme I: Doing Engineering

4.1.1 What Is Engineering and Who Is Engineer?

How do engineering students think of engineers and engineering? To explore how engineering students perceive and describe engineering identity, and how women and men might view this differently, I conducted a survey about images of engineers. In the survey of images of engineers, respondents were allowed to select up to three words which might best describe their image of engineers.

Table 2. Image of Engineer: Frequency of Selections

Gender	<u>Image of Engineer</u>				Function	
	Hard-worker	Busy	Challenging	Diligent	-al	Masculine
Female	58	44	38	29	16	7
Male	95	90	92	58	61	10
N/A	4	4	5	2	6	0
Total (N)	157	138	135	89	83	17

As shown in table 2, “hard-worker” was selected most by engineering students to describe engineers. This was followed by “busy” and “challenging.” However, women and men selected differently for these top three images of engineers. I separated each of the top three categories and examined how many selections occurred in each category by gender.

Table 3a. Image of Engineer: within Men

<u>MALE ENGINEERING STUDENTS</u>			
IMAGE OF ENGINEER	HARD WORKER	BUSY	CHALLENGING
SELECTIONS	95	90	92
PERCENTAGE IN MEN (TOTAL N=176)	54%	51%	52%

Table 3b. Image of Engineer: within Women

<u>FEMALE ENGINEERING STUDENTS</u>			
IMAGE OF ENGINEER	HARD WORKER	BUSY	CHALLENGING
SELECTIONS	58	44	38
PERCENTAGE IN WOMEN (TOTAL N=86)	67%	51%	44%

Table 3a and 3b demonstrate that, for men, their votes spread almost equally for each of the top three images, but for women, the difference between “hard-worker” and “challenging” is much bigger than for males¹. A Chi-square analysis shows that women are more likely to select engineers are “hard workers” than men ($p < 0.03$), while there are no significant differences for busy and challenging.

¹ Because the Chi-square test assumes independence of categories, we cannot do an overall Chi-square. But, we can conduct a Chi-square for each category (either selected or did not select.)

The statement of “engineers are ‘challenging’” seems to connote an unique character of engineering identity. “Hard working” and “busy” may apply to other professions, but “challenging” resonates with how people perceive what science-based professions are. Science-based professions, such as engineering, explore the nature and break fresh ground similar to pioneers. Adventurers and pioneers “challenge” the new world (physical life, nature, or space). As I explore in the narratives, this connotation of “challenging” is common in the narratives of engineering women.

While both men and women do not differ in their selection of “challenging” and “busy,” they do differ on “hard-worker”: women select it more often. Why might women put more weight on “hard-worker” than “challenging?” As I will examine in the narratives, women rely on the idea of hard work as a way to “break into” engineering. It is at the same time, a liberating perception – “I am a hard working engineer and that does not necessarily mean I am masculine like male engineers” – and a constraining perception – “I have to work harder because I am a woman.”

By analyzing their narratives, I examine the dominant notion of the engineer identity and how engineering is conceptualized by engineering women. Drawing on the work of Mead, Smith claims that science, as a social institution, exists in the interactional sequence of telling, finding, and recognizing the objects (Smith, 1999:122-230). From this claim, we can explore what engineering is by pursuing what individuals find and recognize as engineering objects and events.

While accounting for and conceptualizing engineering and engineer identity, women's divergent perspectives converge and reflect their "local actualities (Smith, 1999: 129)" connecting to the larger level of the context or the social structure.

Within women's narratives, dichotomies emerge. So, for example, engineering emerges in relation to non-engineering fields, or to non-engineering characters, such as woman or femininity. Further, accounting and conceptualizing engineering identities implicitly and explicitly are associated with the idea of manhood.

How Women Define What Engineering Is

In the NSF graduate students learning community for engineering and science schools, participants frequently stated that engineering was all about "problem solving." Engineering was supremely related to hard working and good time management. The interviewees for this research described engineers and engineering in similar terms. Some of them had trouble with expressing what constituted an engineering identity because they had never been asked to express their thoughts about it.

Gwen²: I don't know how to say it exactly³...thinking like an engineer... I think it's kind of...every...even a lot of difficulties in biology I think engineering helps me understand it even better. One of the greatest things about engineering is just understanding the basics of how things work in general, whether its math, energy, maybe the fundamentals of like how, just any systems you want to find work. [Master student, Chemical engineering, Black/African American]

Eli: I think it was a mix between the...how can I say this? I enjoyed the fact that it (engineering) allowed me to get into the essence of things, see how things work. I really like to know how things work, so it was attractive from that standpoint. It was also attractive from the standpoint that umm...it seems to be a very vital job, and I guess everybody says this about their field, but I really do feel that

² Except for the researcher's, all names in quotes are pseudonyms.

³ Here and throughout this dissertation, underlines are mine for emphasizing the significance of particular words and phrases for the analysis.

what engineers do is vital and fundamental to the smooth functioning of society.
[Ph.D. student, Civil engineering, White/Anglo American]

Gwen and Eli, graduate students in engineering, were looking for “exact” terms to define what engineering was. They characterized engineering with terms such as “basics” or “essence.” Eli added the actual function of engineering and how engineering contributed to the society. This point was also suggested by another undergraduate woman engineering student.

Messina: [. . .] what was most attractive was that, in all engineering fields what was most attractive was that you’re making a difference. Without engineers nothing in the world can function. Civil engineers build bridges, you know, traffic lights and without these things, the day will not go smoothly. That’s the most attractive thing that, being an engineer. You’re needed and you’re making a significant contribution to society. [Undergraduate junior, Civil engineering, Black/Caribbean]

Messina emphasized the importance or contribution of engineering by saying that “nothing in the world can function without engineers.” This clearly shows that women think about why they become engineers and what it means. They were looking for the association between their engineering career (personal) and the society by focusing on how engineering can contribute to the society.

In women’s narratives, engineering means something real, and the objects of engineering are problems from the “real life” situations. Referring to engineering objects, women engineering students define doing engineering in social terms – practical or pragmatic.

Maali: Umm...for me, I think practical is best because there have been problems where we’ve been given problems or problem solutions for a problem and we’ve come up with one, but it’s not a practical solution...hahah...like no one is going

to do that or that's too hard, no one can ever think that, do it over. So I think the biggest thing is always being practical...make sure something is going to work or has the potential to work. [Ph.D. student, Chemical engineering, Black/African American]

Asked to describe engineering with a particular word or words, Maali stated that "practical" was the best word to define what engineering was. In her account, practical meant providing solutions everybody could use. Practical engineering should provide something that actually worked in real life:

Nikky: I am pragmatic. I'm very pragmatic...umm...that would be the one set of words, that' I would say defines engineering. We are very practical, solution oriented people. See a problem, fix it. It's really, really funny because there is a joke about engineers, who... we have this pile of rocks, we need to move it about 40m that way. Now you stick a group of engineers on it and they'll build you the most cost efficient, time and energy efficient machine that'll move the rocks from point A to point B rather than just take a few hours and move them themselves. It's really, really funny...definitely solution oriented. [Undergraduate junior, Aerospace engineering, Hispanic]

Doing engineering was defined as "practical" or "pragmatic." Nikky added "efficiency" to the characteristics of engineering, and stated how engineers were practical and "solution oriented." By stating "we are practical, solution oriented people," Nikky implied doing engineering was related to personality, and this engineering personality might appear "funny" to non-engineers. This extends to a general attitude toward the surroundings, including nature and society:

Bettie: Umm...well, off the top of my head I would say a word like geeky, but really it's a word like, maybe practical is actually a good one because a lot of engineering problems, all the problems that we do, in our classes, actually are hands on, they really could come up in real life. Like, we work problems over like, jet (inaudible) and so on that actually work on airplanes and most of the problems I do in my petroleum classes are over wells, like drilling wells and they actually could come up in real life...as opposed to like theoretical, you know,

writing essays and stuff. That's why I think engineering is like working problems and other majors are essay writing or English, you know, English essay writing and stuff like that, which we obviously don't do a lot in engineering, but, I think it's more hands on like stuff that can actually, like practical in the fact that it could actually be used, like in real life. [Undergraduate junior, Petroleum engineering, White/Anglo American]

Engineers work on problems that “come up in real life,” and it makes engineering practical and hands-on. Bettie emphasized how engineering was based on real life by exemplifying particular objects such as “jet,” “airplanes,” and “oil wells.”

Doing engineering is finding the problem in real life and seeking the solution to the problem. But, engineering women also defined the constraints of the problem solving approach:

Jill: Problem solving...just simple, problem solving. I don't' think there's nothing to do. I think that's mostly what it is, problem solving and design, which is a part of problem solving. Its' a thought process that you go through to solve problems, whether it be mechanical or electrical. [Graduate master student, Mechanical engineering, Black/African American]

Engineering was a “thought process” to solve the problems, but, according to Jill, it was “just simple.”

Debra: Umm... (engineering is) having the capabilities and abilities to be able to critically think and problem solve. I think that's what engineering-ness is, point blank. [Undergraduate senior, Electrical engineering, Black/African American]

Engineering was abilities to think and solve the problems, but it was “point blank.”

Teri: [. . .] it's a lot about problem solving...you know...they teach you how to do it...that's what engineering is, in your first two years of engineering they are teaching you how to be an engineer...and that is a very rigorous way of solving problems...you cannot deviate from their method, later on they let you deviate, but at the very beginning...I'm serious...every engineering school you take a class where they say, “if you do not turn your homework in on this engineering

paper, we will not accept it...if you do not write the problem statement and draw the pre-writing diagram and do all this, these steps...seven steps or whatever it may be...you will get ten percent off your homework”, and so it forces you into this engineering box, this way of thinking about problems. [. . .] [Ph.D. student, Nuclear engineering, White/Anglo American]

Approaching the problems in engineering seemed “rigorous” and older engineering practitioners did not allow deviation for solving processes. Teri used a particular term, “rigorous” to explain the engineering thought process. Using this term, Teri characterized engineering identity. Zena said:

Zena: [. . .] because engineering gives you a really good base of actually understanding in the field you want to work in but I guess my mind is not that strict as an engineer. [. . .] engineering basically teaches...it’s a strict pattern, you have a problem and you have some assumptions to make and then you solve it. And most of the time there should be, at least, one solution to it and that basically limits your options. [Undergraduate junior, Petroleum engineering, Asian/Kazakhstan]

In Zena’s account, she used words such as “mind” and “strict” for explaining what engineering was. Obviously Zena interpreted engineering as a particular character or something more than scientific problem solving processes.

Bunny: Precision and challenging, because in engineering there is a right answer but it’s a right answer to a T. It’s not 3 it’s 3.056. Like, it’s exacting. There’s no curves, like if you’re going to draw a straight line it’s perfect, you’re going to calculate the slope of that line and it’s going to be with a ruler, whereas in something else that you’re drawing a line, you’re just going to draw the line, but in engineering, it’s definitely different, it’s always exact, it’s always precise and if you’re going to calculate something you’re going to do it three different ways to get that same answer so you know that’s it. So, I would say that. [Undergraduate junior, Petroleum engineering, White/Anglo American]

In women's accounts, engineering is blunt, direct and a very close range. Since engineering does not suggest a broad or diverse range to approach problems about real life, engineering is compared with non-engineering approaches, such as Liberal Arts.

Mandy: I think they teach you how to think. In other majors...they teach you information. In engineering they teach you the thought process, that's how all my classes are, 'This is what you look at, this is where you start from,' and then they teach you where to go from there. Granted, yes they do obviously have to teach you information, but it's a whole mind reset. I just spent three semesters getting my brain reset on how to attack a problem. And I think that's the difference, that's what makes engineering so unique, not to mention the level they hold, in general, engineering students do a higher level of application in their studies because the information is a lot more. It's technically more compressed and sometimes there is no...there is a right and wrong way. Whereas in liberal arts a lot of it is, 'Read the book and you can take it many different ways,' and that's fine, but you need to understand how this works or you're wrong. [. . .] [Undergraduate sophomore, Electrical engineering, White/Anglo American]

Doing engineering was a process to solve the problems in the real life and this particular thinking process is taught and suggested in engineering school. Mandy talked similarly about engineering like other women, but she explained it with "mind set," and then compared engineering with other majors, Liberal Arts. Liberal Arts existed on the different or opposite side of engineering.

Engineering is "hands on" or grounded on the physical life and is the process for finding knowledge to solve problems. So, engineering is precise and strict. Referring to characteristics of engineering, women's accounts place engineering at the opposite side of Liberal Arts, and develop the boundaries between engineering and non-engineering.

Dichotomous Boundaries in Defining Engineering

In women's accounts, engineering is hands-on, physical, solving problems from the real life, practical, and precise. Sometimes women engineering students define engineering in relation to others, such as Liberal Arts.

The women engineering students recognized the stereotypes of engineering as a men's profession: at the same time, women engineering students reject ideas that suggested men were innately superior in engineering. However, ironically their narratives demonstrated that they were also influenced by those prevalent notions.

First, women engineering students addressed dichotomously categorized notions of professions, and they connected this dichotomy to the attributions of genders, femininity and masculinity. Zena said:

Zena: Well personally, I think men are less emotional and female are more emotional. Of course it depends on the different characters, (but) like in general, in engineering we have been a little close minded in order to be something. [. . .] I think you should be...for an engineer, you're supposed to know exactly what you're doing and why you're doing it. [. . .] You start approaching from different ways and there should be strictly one way to approach a problem in order to solve it and I think, because it's my emotional character, that's why...guys are not like that (emotional), (they are more like,) 'ok I got the problem...it looks good...ok fine, let's go...next!' [Undergraduate junior, Petroleum engineering, Asian/Kazakhstan]

In Zena's account, there is symmetry of characters – “men” and “women,” “strict one way to approach a problem” and other ways, and “less emotional” and “more emotional.” Engineering is categorized as “unemotional” and the way it approaches the problems are straightforward, and, according to Zena, it does not coincide with who women are. Zena understands engineering is “strict” and looks for one answer for the

problem, and it does not really coincide with women because women are in the “other” side, such as emotional, open, and broad.

Comparisons between engineering and non-engineering approaches and associating engineering with gender attributions often appeared in the narratives of women engineering students. Diana said:

Diana: Yeah, practical is what I would say because everything that we do is quantified, no matter what we do in life. [. . .] When I started off, I was not so much like this person I am now. I know when I got my job offers, I didn’t just want to go ‘Oh, I love this job,’ emotionally, ‘I’m going with this job.’ I knew that this was probably the job I liked the most but I wanted to make sure, so I made an excel spreadsheet and I literally went through all the salaries, benefits, vacation time, everything, and I tried to quantify it in a way to where I can see it in numbers, so I can see which one was giving me the most. [. . .] So, I have this obsession with quantifying things I guess. I want to know, I want to know side by side what these things mean to me in comparison. I can’t emotionally go with an educated guess. I have to know. It doesn’t always mean that I’ll go with the answer the number gives me but I just want to know what it looks like in numbers. I did the same thing when I apartment hunted...you know, I was like what’s the rent per square floor...hahaha. [. . .] because engineers are very practical and (theater) acting is very...I don’t know, not practical I suppose. To me it’s just kind of the opposite. [. . .] [Undergraduate senior, Civil engineering, Asian American]

Diana places “quantifying” and “practical” at the opposite side of “getting emotional.” She emphasized “quantifying things” by suppressing “emotionally” going with analytical thought process. Using the theater acting example, Diana demonstrates how engineering is quite different from something emotional.

Messina: Well, you see, I enjoy engineering. I think it’s challenging. You get a lot of gratification after you finish a problem or complete a project, but I’m still sort of undecided in that. I’m very interested in social issues. I’m in love with the English language. I like English and I like to write it, I like poetry and creative writing and that is very unusual for engineering student. English is...off limits. English is the worst thing for an engineer. We need numbers and, yes, that’s what we need, numbers and equations and math and physics...that’s what

we need. I really like English. I would actually like to get an English degree but I know that, in terms of feasibility in jobs it would be best to just, you know, be an engineer. [Undergraduate junior, Civil engineering, Black/Caribbean]

When women engineering students were talking about the characteristics of engineering or engineers, they compare engineering to other fields, usually some areas of Liberal Arts. Women engineering students explained how engineering is different from the liberal art majors, and even “opposite” of them, as shown Messina and Diana’s narratives. Diana said she was used to be quite different from what she was now through experiencing engineering. She was “emotionally” approached the work, but now she recognized that was not what engineers needed. Different from theater acting or other Liberal art majors, engineering is “practical and quantified.” Messina also added similar points about engineering. Compared to English, engineering only allowed “limited” answers.

Bunny: She (mom)’s a loan officer. She does math, but she doesn’t do anything. She’s...my mom is very, she’s not the math side either. She’s very liberal and she’s not...she’s definitely not an engineer or anywhere. None of my engineering skills come from my mother, so...yeah, she’s a loan officer. [Undergraduate junior, Petroleum engineering, White/Anglo American]

According to Bunny, “being liberal” and engineering are not compatible. Bunny describes her mom as liberal and not the math-sided and definitely not an engineer. Similarly, Eli accounts for her language art talent as something make her different from other stereotypical engineers. Eli said:

Chu: Do you ever feel you are different from other engineering students?
 Eli: I do...and it’s kind of funny. Like I said, I grew up with an interest in math and science, but I would say that my primary talents are in the language arts. [. . .] So now I have two skill sets instead of just one. And I use them

interdependently all the time. Whereas, if I had been the stereotypical engineer, because they're really good in math and science, I wouldn't have that secondary pool of skills to fall on. So I think in that...that's probably a difference. [Ph.D. student, Civil engineering, White/Anglo American]

Women engineering students defined engineering as hands-on, concrete, and applicable to the real ground, whereas the Liberal Arts majors were defined as open-ended and relevant to the “other side” of world. In these women's narratives, there are apparent two worlds – one is feasible, real, and practical, while the other is emotional, imaginary and artistic.

The perception of engineering as rational, objective, strict, quantified, and practical sometimes threatens women who are traditionally considered not to have those attributions. Julia mentioned:

Julia: I think maybe they (girls) had a different conception of what engineering was about and once they go in they find out it's not what they want to do at all. I think it ends up being a lot more technical than they thought it would be and, not as interesting. I had a completely different image of engineering before I went in. It turned out to be a lot more math oriented than I thought it was going to be. So I think that might be one reason why that scares them (girls) out. I wouldn't say.... I know when my aunt was doing engineering, about twenty years ago, she said the attitude was very difficult and that's what prompted her to change. She went to business because she was doing chemical engineering and the professors secretly treated her horribly, and I won't say that, I'd say in most of my classes were treated as equals, so I don't think that would be a reason for women as much. I don't know...it could be because, I know a lot of them switch out to go to teaching. A lot of my friends switched to go to teaching. So maybe they see themselves open to more interests...more of nurturing interest and they just don't want to deal with engineering. [Undergraduate senior, Civil engineering, White/Anglo American]

To the question of what female students were more likely to leave engineering, Julia suggested the difference between women and engineering. In her accounts, Julia defines

engineering as technical and math oriented, and these features of engineering “scare women out” and let them leave engineering and go to “nurturing” fields. Julia finds the reasons of women’s attrition not from the unequal treatment to women by other male practitioners but from the distance of innate attributions engineering and woman occupy. Julia conceptualizes engineering as an aptitude (an “interest”) which women usually do not possess, and she positions this engineering aptitude at the opposite side of nurturing interest which women usually have.

Distancing from Girly Girls

As shown earlier, many of respondents selected “hard-worker,” or “busy” for the image of engineer, and those terms do not seem relevant to gender or sex roles. However, when women engineering students talked about their experiences in the engineering school and other engineering women, certain attributions, particularly about femininity surfaced.

Chu: Do you think engineering is the field for you?

Mandy: I ask myself that every day. I don’t know. It’s kind of like the further I get in, the more I think I’m getting in way over my head. Not because I can’t do it, because I can...if I couldn’t do it I would’ve switched...but because I know my personality. I know, you know, just the other people I’m with and sometimes I’m very different. [Chu: How different?] First off being female, that has a ton to do with it because most of them are male, and even the girls...even the females I come in contact with, they’re very masculine. Just the way they think and who they are, they’re...I mean, just like...I’m trying to explain this...like, in the way they dress, in the way they talk, in the way they address people...and just in the way that they (behave?). I’m not like that...hahah. I’m not ashamed to say I’m a girly girl...I do that, you know? I wear skirts on a regular basis. I wear skirts more than I wear pants, (but) that “weirds” them out, I don’t know why. I like to read Vogue, that’s cool. Those kind of things. Pink is my favorite color and I’m not ashamed to wear pastels to class. These girls look at me like I’m nuts and all the boys look at me like, ‘What a moron,’ ahhaha. They do. I’ve seen them and I’ve even had them tell me that before. When you hear those kind of things it makes you wonder, ‘Am I?’ You know the movie Legally Blonde? My life right

now is one big legally blonde moment after another...hahah. I'm like the 'shallow' water, they just don't...I don't know, they don't get it. [. . .] I stick out like a sore thumb, and I don't know if it's bad, don't know if it's good. [. . .] I think sometimes I...I don't know, I think they get annoyed with me just because I'm me. I don't know (if) it could just be that I'm a little self-conscious too, but I mean they definitely do. I'm trying to think of another thing...even the way I talk, I'm blonde too, that's terrible, hahah...things like that really does...no one treats you the same, my professors don't even treat me the same. [Undergraduate sophomore, Electrical engineering, White/Anglo American]

Through the interview, Mandy talked a lot about the “personality” of engineers and how her personality was different. She compared herself with “other people.” She clearly claimed the difference between male and female, and, in her accounts, sex difference was analyzed in terms of symbols, everyday practices, and behaviors. She included some female engineering students into the “masculine” category with guys. In this narrative, gender is not just given sex category, it is constructed through actual practices (talking, addressing, dressing), symbols (pink color, skirt), and consequently reproduce gendered individuals, who have the particular way to think and identify who they are.

The conventional feminine symbols, practices and performances are considered deviant in engineering. Mandy used negatively nuanced terms such as “ashamed” “terrible” “weird” and “sore thumb” to describe herself and her different personality from other people. Interacting with other people, Mandy recognized how her personality (femininity) was considered and how this personality (femininity) could not be characterized as the component of being an engineer.

During the interviews, informants mentioned their earlier involvement with student organizations. Some informants were active members of the organizations for

engineering women, but some informants revealed discomfort or negative opinions about the organizations for engineering women.

Emma: They always have this...ummm...kind of sensitive type of topics, kind of complaining about everything and feeling (that) they're less. I mean, for example, I talk with you about this because I think it's important, because it's my point of view in engineering, but I don't go out there and complain about it with somebody else, you know. With everybody else I act normal. But then, for example, I was going to be some women mentoring group for civil engineers and the topic was like, 'oh, we're discriminated...we're treated differently, I feel bad about that, and,' ...I don't know, I feel like, 'Ok, we're treated differently, but see that as an opportunity and not as a hold.' So, I just get so irritated by that, like talking about this stuff makes me mad. So, I really tried to join, tried to join that society and tried to join women in engineering (groups) and I just can't...hahah...I'm sorry. [Ph.D. student, Civil engineering, Hispanic/Mexican]

Emma said, "with everybody else, she acted normal." What does "acting normal" mean? Emma separates "normal" or "regular" engineers from whiny girls. She recognizes how women in engineering are treated, but she wants to present herself as other engineering guys. She complains to mentors who are not related to her actual work area. It's a separation between "real work-engineering" and "whiny girls." If she complains in public, that means she is not a strong engineer like other normal guys, she cannot conform to the normative engineering standard and she cannot be a part of engineering. (But you can complain it in private.)

Whiny girls who are "less" in engineering, are connected to "being girly" or femininity. Emma said:

Emma: [. . .] when you get into these organizations, and girls are so girly, (even) if you're even girl, like, I cannot...I cannot mingle, I just can't. So, for example, in American society of civil engineers, we have girls and guy but that's not the main topic. We can get along together, fine. When you get into these groups, bunch of girls, especially in women in engineering groups...they talk about this

topic...they try to be girly or whatever...that's how it is. [Ph.D. student, Civil engineering, Hispanic/Mexican]

Emma prefers to be involved in the organization for civil engineers because this organization does not make gender, or femininity, salient. Meanwhile, the organizations for engineering women bring topics related to gender (femininity) and they even “try to” be girly (feminine). Emma thought she couldn't “mingle” with femininity salient groups, because it prevented her to “getting along together” with guys.

Bela: I was in Society of Women Engineers, but I didn't like it. [. . .] it's usually like mechanical, civil, or chemical and so that's one reason. Another reason is being...it really is a very, very good organization (but,) I mean, it's more like social hour, girl talk or whatever...hahaha. [Undergraduate junior, Petroleum engineering, Black/Nigerian]

Chu: Ever participate in any associations or organizations for women engineers?
Nikky: I used to...I don't have time for this...and the other thing is that most of them are girly girls and I really, really hate girly girls so I don't associate myself with them...so it's like. [. . .] just things like SWE...society of women engineers [. . .] Like all their meetings were (inaudible)...I'm just like “SHUT UP!” It's a personal thing! I do not like girly girls. I do not hang out with them and they tend to occupy the women in engineer meetings...so like ‘No!’ [Undergraduate junior, Aerospace engineering, Hispanic]

In the narratives of Bela and Nikky, women who are in the organization for engineering girls were called “girly,” or girls who talked about “personal matters.” These girls are whining and crying over how they are treated differently, they are social, and they had girl talks. Bela and Nikky distanced themselves from girly girls by identifying them as something different from engineering. In their accounts, the terms of “social” and “personal” are used to distance these girls from engineering. It seems there

are boundaries between “personal or social hour” and real work, and woman and engineering.

Later on in the interview, Emma advised future female engineering students to be strong and not be afraid. She implicitly addressed traditional characteristics of femininity – fragile, social, and relational – should not be qualities for engineers. Engineering women’s organizations have built strong networks, and some of the informants emphasized how this women’s network is important for women in engineering. However, in the perspective of some women, these organizations look only girly not helpful for being engineers or getting along together with engineering men.

Another woman, Zena, stated that such organizations were only giving undue prominence to women.

Zena: But I didn’t participate in any women in engineering. Probably I should have but then I kind of felt it would really really...I have the stereotype that I would go there and feeling like women there would be like, ‘we are the women in engineering,’...kind of like a feministic approach, I guess, towards engineering. [. . .] In the sense that (they are like,) ‘we are together against the men engineer.’ I’ve never experienced it but that’s my stereotype of thinking. I probably should check it out to see if it’s true, but I’ve never had a feeling for it I guess. [Undergraduate junior, Petroleum engineering, Asian/Kazakhstan]

Women ‘s organizations not only signals women’s bonding or network, but also signifies their gender identity. Involving the engineering women’s organization means “feeling like women” and clarifying “we are the women” in engineering. Clearly identified femininity in engineering is threatening because it goes against the male engineers.

Teri: No, I never have actually (participated in the organizations for engineering women) which is interesting, and probably that’s because I was afraid of what

other people...like the other male engineers around me would think about my participation in those organization...because they're running jokes, I think... [Chu: Running joke?] Like, 'It's stupid (that) women have these organizations. They get everything given to them on a platter. They don't have it so hard.' You know I ...I guess I'm very...I do wonder a lot, like why have I been given all these fellowships and stuff like that...and so ...it's really hard. [Ph.D. student, Nuclear engineering, White/Anglo American]

Teri's account shows that as legitimated authorities, "male engineers" influence women engineers to consider femininity and their status in engineering. Teri stated that she was "afraid" of what other male engineers thought of the emphasized femininity (women's organizations). In other words, they are saying that from male's perspective, women invade or infringe men's field and take rewards (such as fellowships) which men should take.

Women's narratives show that, as a visible challenge, female organizations may threaten the majority of engineering practitioners, men. At least some of the engineering women think the participation in female bonding may distance them from blending into the core, and make women infringement of the male field more prominent.

In informants' narratives, as another visible femininity symbol, motherhood and other kinds of nurturing behavior are not viewed as compatible with engineering.

Bela: Well, why do women want to switch? Maybe...I guess there's a lot of...I mean, I know there's a lot of females that have aspirations, like we were talking about earlier, to get married and have children. That's their plans and a lot of them think, 'What am I doing?' So maybe that's why a lot of females, majority of females decide to switch...umm...why else...that's the only thing I can think of. Maybe they just don't want to put up with it if they're going to end up quitting anyway because they want to raise a family. That's the one reason I think they do that. [Undergraduate junior, Petroleum engineering, Black/Nigerian]

Bela relates switching or leaving engineering to women's "aspirations" of nurturing. In her accounts, nurturing and raising family make women engineers wonder "what they are doing" in engineering. It demonstrates the possible conflict between women's aspiration of nurturing and doing engineering. To avoid or resolve the conflict, women leave engineering. However, Bela distanced these women from herself. Raising and nurturing are "their plans," not hers or ours.

Narratives about women engineers who left engineering to raise their families show that engineering women recognize the salience of gender and how gender identity is understood in the engineering school. However, they seemed to wipe gender, particularly femininity from engineering. This demonstrates the inconsistency and conflict women experience in the engineering identity construction process.

In Affect Control theory, EPA (evaluation, potency, and activity) of certain objects demonstrate association between socially created fundamentals of the objects and individuals' perception of the objects. So, this approach can demonstrate the conflict between what is expected, what is commonly shared idea about engineering and what actually is.

This research surveyed engineering students to examine the EPAs of engineers and other statuses in society. In this survey, respondents were asked to express their emotional EPA (range from 1 to 8) toward certain objects--man, kindergarten teachers, nurses, and engineers, professions traditionally segregated by gender. Do men and women have different feelings about the goodness, powerfulness, and activity of engineers or other occupations? There were some interesting differences in evaluations,

but not by gender. In fact, the only gender difference emerged with the EPA for men: Male engineering students gave the term “men” a higher rating for goodness than did female students ($p < 0.04$).

There was a significant difference in classification for evaluating engineers by years in the program. Freshmen’s mean score of EPA toward engineer in terms of goodness was 6.7; Sophomore’s score was 6.29; Junior’s was 6.29; Senior’s was 6.28; and graduate was 5.6. For the value of engineer in terms of powerfulness, freshmen scored engineer 6.7 and graduate’s score was 5.6. Thus, one can say that younger and less advanced students in engineering school evaluate engineers as better and more powerful.

The EPA of occupations reflects how engineering students evaluate professions differently. With respect to goodness, engineers were rated from 6 to 8 almost evenly. About 27 percent of the respondents score engineer in terms of goodness was 6, and about 28 percent of all the respondents score was 7. Meanwhile, kindergarten teacher was evaluated pretty high in terms of goodness. 66 percent of the respondents scored kindergarten teacher 8, the highest value. However, compared to engineer, kindergarten teacher has much less power. Many of the respondents rated the power of kindergarten teacher as 2 (16%), 3 (18%), and 4 (26%), while engineer was rated as 5 (20%), 6 (24%), and 7 (29%).

This Is What My Dad Said about Engineering

The way women engineering students define engineering and engineers is also deeply associated with gender roles in the family and underlying assumption about

gender and professions. When women engineering students were asked about how they decided to study engineering in college, about half of them said how father influenced them substantially for making the decision.

Eli: And so I sort of explored a couple of fields...umm...and my father is actually the one who got me interested in civil engineering. [. . .] umm...my father and I are very close so we do even now talk about what led me to engineering....we certainly did at the time. I think that my parents in a great way shaped my desire to go into a science related field. [. . .] and my father has this uncanny knack for making suggestions and then they turn out to be right. So, I don't think...I don't think he was surprised because I do typically follow his advice and usually he gives really good advice. [Ph.D. student, Civil engineering, White/Anglo American]

Eli explored a couple of other fields for majoring in college, but she ended up in engineering, a decision influenced by her father. As shown in her narrative, she believed her father was a good advisor who had the “uncanny knack” for making suggestions, and his advice usually turned out to be “right.”

Teri: [. . .] my dad was really happy that I was going to be an engineer. He's a geologist, he works with a bunch of engineers, you know, he liked it, and umm...we had some family friends. When I was applying to school the guy was saying, ‘Hey, you should be an engineer. There's a big (boom?) in engineer,’ so he'd tell all the, you know, seniors in our church, ‘Hey, you guys should all go be engineers.’ [. . .] I've talked to him (dad) ever since I've been in school (college) we talk a lot about engineering. He's really interested in what I do and I have, you know, three other sisters and my mom and not all of them are interested in this sort of stuff and so we talk a lot about what he did at work and what I'm doing in school...and things like that. [Ph.D. student, Nuclear engineering, White/Anglo American]

“Engineering is one of those things that you learn about when you are a small child, but you have no idea what exactly the job is or who it pertains to. I loved the stars and racing when I was a little kid. My dad pushed me to explore both of them, as most parents would have probably done. I had a real knack for science (and my mother hated me racing) so my dad started to encouraged me to become an astrophysicist. [. . .]”

-Autobiographical essay, Helen, Undergraduate senior, Aerospace engineering, White/Anglo American

Both Teri and Helen contrast their decision to study engineering as opposed to other women in their family (in Teri's case, her sisters and her mother, in Helen's case, her mother). Compared to her mother, their father gives women engineering students more detailed and specific information of engineering:

Kelly: I think, probably the physics teacher was influential, but also my dad because he's an electrical engineering major and so I kind of talked to him about what engineering entailed and stuff like that to see if I would really like it. But, he wasn't trying to persuade me any certain way. I mean obviously, he's an electrical engineer, I'm a mechanical engineer...very different, but he was a good shoulder to talk to and figure things out. [. . .] [Undergraduate senior, Mechanical engineering, White/Anglo American]

"I initially found aerospace engineering to be an attractive field because it reflected many of my childhood interests. Growing up, my father had taken me out to the flight line to show me some of the aircraft that he flew, such as the T-38 and KC-135. Attending air shows with my family, celebrating Memorial Day, and supporting Operation Desert Storm instilled a love for the United States and an understanding of the price of freedom deep within me. Outside of the military, my father also introduced me to hands-on engineering experience by building and flying model rockets with me, letting me help rebuild his private general aviation airplane, and taking me to fly while explaining basic principles of lift and drag."

-Autobiographical essay, Jasmine, Undergraduate senior, Aerospace engineering, White/Anglo American

Jasmine had "hands-on engineering experiences" with her father. Her father explained the basic principles about aircraft flying, and introduced her some real engineering experiments by letting her participate in his work. May said:

May: It was more of a process of a decision because my dad is an electrical engineer and he, he stressed the math like, I was home-schooled so, my mom taught us the reading and writing and the basic math, write, but my dad took the math part and made it exciting. We'd go sit in his office and play with math, so

he really influenced that aspect of it. And then...just to put together different puzzles with him to see his dedication to solving a problem. That was a big...so, it was pretty much my dad, and math kind of seems to mesh with me...so... [Undergraduate junior, Electrical engineering, White/Anglo American]

In May's interview about her decision making of studying engineering, gender roles in the family were apparent. May learned reading and writing from her mother, and learned math and science from her father through home schooling. According to May, her father showed how to do math and science, and she emphasized her father's influence on her decision by saying "it was more of a process of a decision."

Bettie: Actually my dad was one of the ones who was like, 'Yeah, that would be a really great idea for you. You should pursue it, work on it,' he was actually pushing me more towards chemical engineer, but I don't like chemistry very much, so I was like, 'I'll stick to something else,' but, he works for Exxon mobile, so when I told him I didn't really want to do Chem E, he was the one that suggested, you know, 'Why don't you try petroleum engineering. The market is opening up for petroleum.' It was like right when the market started getting better and better, I mean, like now it's awesome for petroleum engineers, so he was like it'll be a really good field to get into right now. So, that helped my decision more. [Undergraduate junior, Petroleum engineering, White/Anglo American]

Bettie's decision to study Petroleum engineering was specifically suggested by her father. She clearly gives him credit by saying "it was right...it is awesome" for studying Petroleum engineering. Fathers' advice also informs daughters about what is more intellectually challenging:

Julia: Maybe it was my parents because my dad always tried to encourage me to go strongly into something of math and science. Because when I was in the 7th grade I wanted to be a teacher and he's like, 'no, I want you to do something that you can use your abilities in,' so when I was 14yrs old he sent me to this math camp for a couple weeks and it was actually pretty interesting and that was what first opened my eyes. [. . .] I would say it was mainly my dad that kind of pushed

me to engineering. [Undergraduate senior, Civil engineering, White/Anglo American]

Mandy: [. . .] well, I did well in all my subjects; math , science and the liberal arts, but I always enjoyed the liberal arts more...so I thought about law school, I also thought about becoming an obstetrician too, [. . .] But I was talking to my dad about it and he wouldn't hear of his daughter wasting her life away as an English major...hahha...or history major and then going to law school...I don't think he liked that idea very much, hahha. [. . .] He's a software engineer and he read an article in the paper about how engineers are getting ready. A lot of the engineering workforce is getting ready to retire because most of them were baby boomers that all started with the space race, so he started leaving hints around the house that I should consider engineering...then we had our serious chat about why I should become an engineer....hahah. [. . .] He just said, 'You should really think about it. You've got a good head on your shoulders. I know you're smart, you're a smart young lady, and I know you have more for a major in history.' [. . .] I thought about architecture too. It came down to architecture and engineering and I chose engineering. My dad kind of influenced me. [Undergraduate sophomore, Electrical engineering, White/Anglo American]

In women's autobiographical essays and interviews, mother's influence on their majoring decision was much less substantial. Women engineering students talked about how their family members reacted to their decision, but mother's responses were usually described as emotionally supportive: "She is excited, happy for me, or supportive to whatever I do." On the other hand, often fathers informed their daughters about engineering. They provided hands-on engineering experiences, and they suggested concrete information about real world, such as market situations and job opportunities in engineering fields. Further, some fathers implied who should be engineers (smart and intelligent people) and how engineering is different from non-engineering fields, such as Liberal Arts. Many women engineering students say that engineering is hands-on, practical, functional and real, and their ideas about engineering seem deeply related to their father.

However, this seemed most often to be the case for White women engineering student and not characteristics of minority women engineers. Minority women rarely talked about their father and how he influenced her to be an engineering student. They talked about family support, but it was usually stated in terms of the family's emotional support.

In their study about life and career struggles of successful White and Black women in corporations, Bell and Nkomo (2001) claim that the father-daughter relationships are different in terms of race, and the different patterns of the relationship is also linked to their social classes. Bell and Nkomo further argue that even though Black and White women workers similarly encounter unequal treatment based on the sexist social structure, they are shaped in different ways to develop the relationships with men in corporations.

Who Is Going to Be an Engineer?

How do the women engineers feel about who chooses to study engineering? According to the women, doing engineering is based on abilities, personalities and expectations engineers are supposed to possess or perform. At least for White women, interpretations of engineering identity seem deeply related to their fathers.

Asked to describe the image of engineer, Julia answered:

Julia: Umm...it's just that I meet a lot of off the wall people in engineering, especially my freshman year, there were people, especially the computer science majors, they would make jokes about the little...internet works and stuff. They would make jokes about it. I think they're just really technical people and, I don't know, they have to find humor in it somehow, entertainment...hahaha...I'm not saying everybody is, but a lot of people I've met they admit to having a nerdy side...hahaha [Undergraduate senior, Civil engineering, White/Anglo American]

Chu: what do you think makes engineering unique?

Bettie: [. . .] stereotypes are there for a reason and I've met a whole bunch of engineers that really are the nerdy...the nerdy type, you know, that don't go out, they don't have any friends, they play on their computer, stay in their dorm rooms all the time, but, there are a lot of normal engineers...hahaha. [Chu: normal?] Yeah, you know, people who still like to go out, hang out with their friends and, you know, they have other interests, like sports or music or whatever, and...but, in general engineers are different. Because we just don't really value our personal time. We like to dedicate it all to school, that type of thing. I'm not saying that other majors don't work hard, because I know they do but since I'm in engineering, I see it as engineering is one of the hardest majors on this campus and so...it's just...you have to be in a different mindset to go, going into the college you have to know that it is one of the hardest majors...so... [Undergraduate junior, Petroleum engineering, White/Anglo American]

Being “nerdy” is interpreted “abnormal” and “off the wall” in Julia and Bettie’s accounts.

In Julia’s account, nerdy engineers are “technical” people and they make fun of techniques they use. In Bettie’s account, there are some “normal” engineers. “They” have some “other interests.” But, Bettie identifies herself as one of the nerdy type, who “do not value the personal time.” Bettie initially identified nerdy engineers as “them” but she found some commonalities (mind set) between herself and them.

Nerdy is an abnormal characteristic, but it also shows how engineers are good at using engineering techniques and knowledge. Women engineering students recognized their stereotyped character can be interpreted negatively, since it is not normal, but they identify it as a part of themselves. “Being stubborn” is also interpreted positively in women’s accounts:

Chu: Can you name specific character or personality for an engineer?

Zena: Stubborn...hahaha...you have to be really stubborn, you know, to do (engineering), to be able to. Sometimes I see myself sitting in the lab for ten hours straight trying to figure out how to do a stupid graph, to understand what is it showing and it doesn't get anywhere and you just want to drop everything, just want to go home and sleep or something and being able to be really stubborn in

the sense of ‘yes, I have to finish this.’ Just being (stubborn), I guess, that’s really a good character to be (an engineer).” [Undergraduate junior, Petroleum engineering, Asian/Kazakhstan]

Zena describes “being stubborn” as a good characteristic for an engineer, even though she implied it might not be defined as positive by other people (she laughed, just after she stated “stubborn”).

Through experiencing engineering school, engineering women learn what personality is desired or what life styles are expected for be an engineer. One of the most important of the characteristics is perseverance:

Gwen: ummm...I think perseverance, hard work, how well you work in relation to other human beings. I’m not sure, heheh. Those are the things that first come to my mind. If you can communicate well with people, if you understand and are competent of what you’re doing, and just, just diligence and perseverance, I think, because engineering is not easy...it’s very challenging. [Master student, Chemical engineering, Black/African American]

Gwen emphasizes “perseverance” as a character an engineer should have. Consistent hard working is suggested as character making individuals do well in engineering while working with other engineers.

Julia: Well, I think intelligence has a lot to do with it, but my main thing is work ethic because you can get very far by just how hard you work and how passionate you are about doing something. [. . .] I know a lot of really smart people, but they’re lazy. They don’t care about homework assignments, they don’t care about studying for tests. And I think that’s really a predictor of how far you’re going to get in the workplace. If you don’t care about turning your assignments and what grades you make right now, what’s to say you’re not going to care when you get to your workplace. And so...for me, if you work hard and you care about what you do, even if it’s just a homework assignment, I think it’s a predictor of how you’re going to do in your professional life. [Undergraduate senior, Civil engineering, White/Anglo American]

To the question of the strongest predictor for a successful engineer, Julia compares smartness and work ethic. Even though intelligence is an important element, a “work ethic,” such as keeping a schedule for assignments or preparing tests, is more significant for constructing an engineering identity. May described:

May: Generally, you need to like math because you’re going to see it a lot, and you probably, if you’re the kind of person that likes to go out every weekend and do the party thing, the weekend is the time that you’re given to work on assignments. The course syllabus for my two hour 112class said, ‘You’re expected to spend no less than 15hrs a week outside of class on programming,’ umm...and, at this time in the semester I think they undershot that figure. It was, it went way beyond 15hrs a week. So, you have to be able to devote time to it. You can’t have other things get in the way...hhaha. I can’t date, at least not right now, because they weed out courses are definitely difficult. At this point in the game, you have to be committed and you have to love what you do, so... [Undergraduate junior, Electrical engineering, White/Anglo American]

In May’s account, “having other things” such as “going out weekend,” “partying,” or “dating” seem to prevent women from constructing the appropriate engineering identity. May and Julia clearly demonstrate the engineer group identity by comparing “doing other things (partying, dating or being lazy) to those who make it in engineering programs.

Related to this theme of consistent work is attention to organization and time management. Engineering students learn how to organize their life to be effective. Entering engineering school, individual life is patterned according to the expectations and regulations suggested by the organization (Seymour and Hewitt, 1997; Schiebinger, 1999). This idea is echoed in May’s comments about the amount of time required in her classes and the importance of weekends to “catch up.” Zena also said:

Chu: Can you choose specific word for describing an engineer best?

Zena: Actually, I wouldn't say that engineering field was naturally hard. I mean, it's not really hard in the sense of understanding or being able to understand the material. It's more hard because it's really a big load of home works and labs. It's really, really time consuming and all these test we do all the lab procedures. They take hours to do, thus you have to be organized in order to manage your time and be able to turn in everything. [. . .] The most challenging part is to organize my time well. That was the biggest challenge, because as far as doing everything...you understand everything, you pass your test well. [Undergraduate junior, Petroleum engineering, Asian/Kazakhstan]

Zena characterizes engineering as a “time consuming” work, so how to manage the time is one of the most important features describing an engineer best, and make someone an engineer.

Diana: So, for me, I voluntarily take all 8oclock classes so that way I can get up in the morning go to class, (and) spend the afternoon doing homework and by 5 I'm done. You know, I go to the REC, do whatever for the afternoon and get (inaudible), maybe a little catch up homework after that but I try to make it a very Monday through Thursday and then Sunday effort. [. . .] So, I try to treat it like a job, like if I'm at school and I have an hour free time but because its between 8-5 I should be doing homework or something related to school and you'll find that most of the times you'll get your work done that way, I don't know. I think it'll be better because when I go out to the workforce, I'll already have that mindset so 'I'm at work,' so I should be doing work. [Undergraduate senior, Civil engineering, Asian America]

Diana provides an example of time management for doing engineering. She explains her organized daily life as what need to be a good engineering student and a future engineering in the real work place.

Notions of engineering identity or engineering are deeply relevant to the organizational members differently based on their local actualities in the context. When engineering women were talking about their experiences in engineering, such as competition, male bonding, or unequal treatment to women, they demonstrate how

engineering is constructed through interacting with others and the organizational context, and how construction of engineering reflects the socio-cultural boundaries of science and non-science, or objectivity and subjectivity, or man and woman.

4.1.2 Engineering Culture, Engineering Atmosphere

“Yeah, We Do Compete a Lot”

In engineering women’s narratives about being (becoming) engineers emphasized adopting certain personalities, attitudes, and life styles. Competition, as a social interaction, complements what engineering is. Competing for grades is an element in traditional male-dominated educational institutions. Competition is about “winning,” which is the most traditional way of placing individuals in the ranking system of the organization (Seymour and Hewitt, 1997: 263), and it is metaphorically represented in sports or games traditionally invented and maintained by men. Students compare their grades and redefine the purpose of grades. Maali described:

Chu: Are there any specific norms or expectations for engineering students?

Maali: Yes...yeah...umm, pretty much, you know, as an engineering student if you make C’s in all your courses, it infers that you don’t need to be an engineering student, and, you know that in order to be an engineering student, you need to do good in your classes and you need to master the material learned and be able to remember all of the formulas and all of the constants and all of the information, be able to remember that all times, and so...they place high demands on you. [Ph.D. student, Chemical engineering, Black/African American]

Here, “As an engineering student,” or “in order to be an engineering student,” it is “demanded” of students are “demanded” to have good grades in classes. In Maali’s account, getting high grades seems a norm that must be followed.

Chu: How about competition among students?

May: Yeah, there's...engineers, I think by default, are competitive that way. When it comes to sports, I just like to get out there and have fun, I don't care about winning, but when it comes to the competition in engineering...that is like, it's the whole 'My gadget is better than your gadget,' 'I found a better way to solve a problem than you did'...there is definitely competition. [Undergraduate junior, Electrical engineering, White/Anglo American]

May characterizes competition in engineering as competitive "by default." She compares sports to the competition in engineering and implies competition in engineering is not about fun but by demonstrating 'I am better than you.'

Jill: Undergraduate...that's all it was...competition. I mean, because it seems like we're all trying to, we're all trying to get to the same goal, and that's graduating with a job. So you're competing against all these other people and there're only so many jobs out there. So, you're trying to get the best GPA, the best grades in the course." [Graduate master student, Mechanical engineering, Black/African American]

Jill perceives that the reason for competition in engineering school is that engineering students had the same goal. Jobs are limited, so students want to have the best GPA to get selected. Jill's explanation of the competition in engineering school is different from May's. Jill explained competition with a rationale – the association between the job market situation and GPA, while for May competition in engineering seemed a winning game just for winning. As a strong group consciousness and ritual, in May's narrative, competition was practiced by each student in engineering. Obtaining good grades and competition are expected in engineering school. Sometimes, competing with other engineering students requires more than just hard work. It becomes a survival game.

Chu: Any expectations or norms for engineering students?

Debra: Umm...I think, for engineering students, there is definitely pressure to be at the top. It's very, very competitive. And sometimes students, they get into trouble because they may collaborate or cheat or something, you know, but that's a totally different story, but I just think that the expectation is to maintain a certain GPA, but sometimes it's just so hard to maintain that certain GPA, because there is so much work and pressure and competition and...sometimes it's a struggle and sometimes people expect you, like you said, to be nerdy or to have a calculator all the time. [Undergraduate senior, Electrical engineering, Black/African American]

“To being at the top” is a “pressure” for engineering students and this sometimes brings “cheating.” Debra stated that doing engineering (maintaining certain GPA, hard work, competition) was a “struggle.” Thus, to be nerdy (personality) and having a calculator all the time (behavior) are expected for engineering students. Bettie also said:

Bettie: Get good grades. That's always, always talked about in class, between students, not with the teacher, but, getting test grades back, quiz grades, home works. Once everyone gets them back it's like 'What did you get, how did you do?' you know...so, it's really...like there's a lot of pressure put on good grades. [. . .] Oh yeah, it's a lot of competition. Even like, even just for little stuff. Home work is 5% of your total grade and once everyone gets it back it's like, 'Oh, how did you do, let's compare,' that type of thing. And, you know, you will find that there are lots of people who covet that. They're like, 'Oh, I'm not sharing.' They don't even enter conversations that have anything to do with grades. They're probably the people with the 4.0 but yeah, grades is, it's big competition in engineering class, more so than all my electives I've taken, where when you get the test grades back, no one really talks about it, but in my engineering class it's really (there)...yeah, no one really talks about it." [Undergraduate junior, Petroleum engineering, White/Anglo American]

Bettie compared the competition in engineering to winning a game. This practice is obviously conducted but invisible. To do better than others, students do not share the information, and they “covet” the top grade. Despite the obviousness of competition, “no one really talks about it.” Bettie is subtly addressing how this competitive practice is not a positive characteristic of engineering.

Competition is not merely a straightforward notion of who did the best as measured against a body of required knowledge. It is elaborated by the curve system, which explicitly pits students against one another.

Debra: Yeah, there's definitely competition...sometimes even backstabbing, I guess you could say...ummm...competition in the sense of grades and, you know, people trying to get over, I guess, the curve you can say...I'll give you an example. The project I was describing earlier, the hybrid car, whatever, a lot of people were having trouble with the project. Of course, me and my group got together, we were trying to do the project and whatnot, but there was this one certain girl in our group, [. . .] I suddenly noticed that she wasn't showing up to our little group meetings anymore. And then we had found out, maybe two or three days before the project was due, that she had gotten a spreadsheet from somebody else that had all the correct formulas in it but she didn't tell us. [. . .] And just to know that she held back that information from us...I guess she just wanted to make a better grade than, you know. I know she wanted to make a good grade on the project, it's just competition like that. Where it starts to get really shady, just makes people upset, and so that competition is definitely there, you know, to the point where people will withhold information from other people, stop showing up to study groups, just so they can have that extra edge on other people. [Undergraduate senior, Electrical engineering, Black/African American]

Debra explains the competition in engineering as a practice “making people upset.” She uses some derogatory nuanced words such as “backstabbing,” “shady” or “extra edge” to characterize the competition in engineering. The curve system makes students concerned with others' grades. This system seems inherently contradictory, as Zena points out: students are competitive even though they are encouraged to work together cooperatively.

Zena: I don't think I have any enemies, in a sense, like that, if there (is) someone who doesn't like me that much but, that's still like professional competition because your average grade is going to reflect your curve and if your curve is, if your average grade is low the curve is going to be higher. So people want other people to do bad to get a higher curve. [Undergraduate junior, Petroleum engineering, Asian/Kazakhstan]

It is well known that curve system makes students competitive because it creates a zero sum incentive system: if one person gets an A, someone else will not. In engineering, competition is everyday life and even encouraged by professors by the use of the curve system. Curve-grading is the “engine” which drives the competitive atmosphere in the engineering classrooms (Seymour and Hewitt, 1997: 118). Engineering students are forced to compete with each other, and through the consistent competitive interactions and practices, they identify being an engineer as engaging in competition. This seems to generalize from grades to other types of interaction as well as noted by May when she says that there is an atmosphere that encourages the “my gadget is better than your gadget” mentality.

Engineering students are competing against each other to get the legitimated and higher status in the intelligence hierarchy, and the organizational context of engineering school encourages them to do so. The engineering system encourages students to contest their intelligence and knowledge against others in which is essentially their reference group, their community, and professors also evoke the competitive atmosphere in classrooms.

Chu: Based on your experiences, what are pros and cons in engineering?

Gwen: I don't know...pros and cons of engineering school. I don't know if this is accurate, but for me I think they must be, I don't know if it's just the school or if it's the discipline, I don't know, but I think engineering maybe a little more competitive, I think, (it is) more competitive than biology. Biology, I believe that we, there's a lot more cooperation. In engineering, I think they push the cooperation, but, I don't know, still I see competitiveness even in that. So I believe that's just something different about it. [Graduate master student, Chemical engineering, Black/African American.]

Engineering pushes students to cooperate, but at the same time, it supports competition. When she talked about this, Gwen stated “I don’t know” several times, and wondered if her opinion was accurate or not. This might suggest that Gwen was ambivalent about this aspect of engineering.

Julia: Well, it’s not something the professors necessarily try to egg on, but for me, I’m a competitive person. So if I see someone else makes a higher grade, I ask myself, ‘why didn’t I make that grade,’ and so it’s kind of good, it pushes me to study more, but at the same time it’s very frustrating because there’s always somebody whose grades are better than you in class. Especially if...a couple of times I’ve made below the class average on a test, (and) that’s really frustrating because I’m wondering, ‘why didn’t I make like everybody else did. But the really...people judge you by the grades you make on your transcript and when you’re going out to interview they look at that grade on there...and, so for me, it’s very important. [Undergraduate senior, Civil engineering, White/Anglo American]

Julia thus describes the competition of engineering in terms of the structural atmosphere of engineering fields. She began to talk about her competitive personality to explain the competitive phenomena in school, but found the connection between individual competitive behaviors or attitudes and the surrounding as “judging individuals by their grades.”

Chu: Based on your experiences, what are pros and cons in engineering?

May: [. . .] Being in the engineering school, you tend to, you have to do that, quite often, to be able to succeed. And the teachers, especially in the freshman classes they’re just kind of like, ‘Well, half these kids are going to drop out or transfer to a different major.’ So, they don’t...they tend to not spend as much time with individual kids. So, like on applications, they’ll ask for teacher references, and I really don’t have one, because they don’t seem as willing to make connections with students this early in the game, and that gets kind of frustrating. I mean, it might not be that way, but that’s definitely the way it comes across. [Undergraduate junior, Electrical engineering, White/Anglo American]

May emphasizes how competition is encouraged by other aspects of the engineering school such as professor's attitudes and weed-out courses. "Early in the game," engineering students recognize that some professors do not care if students succeed or not. As May identified, it is a "game" about who should fail and who should advance to the higher level.

Diana: I remember the first day I walked into my engineering class they said, 'Look to your right, look to your left, the dropout rate is one of out three, so if both your neighbors are still in engineering next year, you're probably not.' Not saying they're going to fail you. Just that the statistics are one in three drop out after freshman year. That is actually true. They're not saying 'I'm going to flunk you,' but they're saying 'Be competitive, know that these are people you are competing with, know that these are the people you have to compete with to get into the department of your choice,...so know you're competition.'
 [Undergraduate senior, Civil engineering, Asian American]

Diana's account about competition shows that the competition is justified for "weeding out." Professors do not "flunk" students, but unqualified students are flunked by the competition.

While taking so-called "weed-out" courses ("early in the game"), engineering students encounter the situation coercing them to be competitive, and this practice is supported by the ideology or culturally dominant idea of what engineer should look like. Many of the students have only a few points of comparison, but when they compare engineering with other majors, they perceive less competitive emphasis in the classes or through the teachers. This conclusion comes through comparisons in their elective classes or in the case of Gwen in her biology classes.

The Myth of Engineering School

People, including students in science and technology-based fields, believe that math and science require a “special calling” or “genius (Schiebinger, 1999: 80).” Engineering students must be extremely intelligent to be successful.

Eli: I think in the beginning, initially, it struck me that everybody was so caught up with intelligence. Engineers at least carry around this myth that the smartest people go into engineering. This was especially prevalent in my freshman and sophomore year. I think you realize, later on, that are fields are valuable, they’re smart people, and good work done in all fields. Those first two years we were a pretty arrogant bunch. So, this intelligence being sort of a vital commodity in the field, I think everybody was almost a little bit scared that they were going to get into these weed out classes you have in your first two years and they were going to realize they didn’t have the stuff. I certainly remember being afraid of that. [Ph.D. student, Civil engineering, White/Anglo American]

The belief, intelligent people do engineering, seems a dominant idea of the engineering identity. Students are “caught up with” intelligence, and they try to prove they are intelligent in the first two years of engineering school. Being intelligent is critically important to succeed or survive in engineering, because it is a “vital” commodity in the field. This dominant cultural belief produces losers not only by dropping out but also by prompting anxiety and fear. Nikky explained:

Chu: In your own terms, can you explain what the essence of engineering is?

Nikky: [. . .] It’s you. Being an engineer means that you have to be somewhat intelligent. You have to be smarter than your average Joe...umm...because some of these problems just, as whack as they may be there definitely a challenge. Yeah, and to be an engineer is to be a geek, you spend most of your time working because engineering school is that difficult. [. . .] As far as engineering myths, I guess first and foremost, in adjective I would describe it would be dedication to your work, because if you don’t have that you’re not going to make it through engineering school. So, yeah, you’ll drop out after awhile if you don’t have that. It’s...you also, it’s just so hard. You have to be able to think analytically and numerically at the same time, if that makes any sense to you. [Undergraduate junior, Aerospace engineering, Hispanic]

In Nikky's explanation of what engineering means, intelligence is emphasized. It is echoed Eli's point about "arrogant bunch" in the early years of engineering school. Nikky clearly categorizes engineers as "smarter than average."

Another woman, Gwen provides an explanation of competition in terms of engineering by itself:

Chu: Can you talk a little more about competition?

Gwen: I think, because engineering is a creative discipline, people want to come up with new ideas. You don't want to come up with something and then somebody else takes credit for it, you want to stand out. I think that's the thing about engineers, they want to stand out. They want to show how their ingenuity, because engineering is about ingenuity, how this is their ingenuity. I think that's where that stems from, I'm not sure though, but I think that's one of the reasons, just like, I don't know. I think it's also going to depend on the class maybe. The group of people at that particular time, I don't know... In my group, I feel that there is competition in that just everybody wants to stand out, they want to be at the top of their class, I don't know... [Master student, Chemical engineering, Black/African American]

Gwen states "ingenuity" several times in her account of how and why engineering students compete each other. She identifies engineering as a field in which individuals contest their ideas. Gwen points out the innate features of engineering produce competitive atmosphere. Many of the women, though, reflect upon the intelligence dimension and find it to be a myth.

Chu: Do you think engineering changed you a lot?

Julia: I learned just really how to prioritize my time, so.... I'm proud of being a part of it, but like I said earlier, at the same time I think sometimes we're overrated. I think there's a lot of other programs on campus that are just as hard (as engineering, like) business, but we just, I don't know, we get singled out...hhaha. [Undergraduate senior, Civil engineering/White/Anglo]

Chu: Are there any specific norms or expectations for engineering students?

Julia: Well people just expect us to be smarter...hahaha...I don't know, I know whenever I go to the supermarket, my mom and someone messes up the cash

register says, ‘well you’re an engineering major so you should know the math.’ They expect us to be geniuses with the math all the time. That’s not true. I don’t know they just have this high expectation for us that we don’t fulfill all the time. We’re just normal (inaudible)...they set us apart automatically...whether or not we deserve it. [Undergraduate senior, Civil engineering, White/Anglo American]

There is a recognition that “genius” engineers are, indeed, a myth. Julia clearly mentions engineering students are “overrated,” and in her supermarket story she is dealing with math stereotypes about engineers, and then states “we are just normal.”

As the narratives point out, there is a realization that there while it is a “myth,” students still felt cultural pressure to prove that they are smart enough to be engineers. And Eli chides herself and her colleagues by admitting that “we were a pretty arrogant bunch,” clearly establishing that there are many intelligent people in fields different from engineering.

Nevertheless, the intelligence stereotypes create an imperative to differentiate us (real engineers) from others (non-engineers). Bela said:

Chu: Do you ever feel you are different from other engineering students?

Bela: Other engineering students...I think there’s a lot of very, very more intelligent engineering students. I mean, it’s hard, it’s really challenging and there’s some people that it seems it’s not as hard for them, but maybe it’s easier for them so that makes the difference between me and them. [Undergraduate junior, Petroleum engineering, Black/Nigerian]

Bela differentiates her and “them” by intelligence. For her, engineering is hard and challenging, but for them it seems not as hard. Competition not only functions to differentiate real engineers from others, but also create feelings of failure when they do not meet the standard. If someone fails to prove her or his intelligence in the approved

ways in group, this member can not obtain the legitimate status as a proven group member (Lorber, 1984; Haas and Shaffir, 1987). Additionally, identity control theory would predict that whether or not the identity standard is myth, it still determines how an individual reacts. And when the standard is not met, stress results which then produces anxiety (Burke, 1991). This is demonstrated in Eli and Bela's comments that it is "scary" or she is "afraid" if she is not intelligent like others (Eli), and that perhaps it is harder for her but it seems easy for others and this is a "difference between me and them (Bela)."

Others, however, clearly recognize the dilemma involved in playing too much attention to the "smartness" images:

Zena: I guess because I'm not one of those people who is afraid of looking bad or looking stupid or something. There are actually some people who don't understand something but they won't ask a question because they don't want to show that they don't understand something...kind of trying to control the 'image' of you being smart. [Undergraduate junior, Petroleum engineering, Asian/Kazakhstan]

In Zena's account, there is anxiety or stress among engineering students about whether they meet the seemingly normative standard of engineering identity, intelligence. Thus, competition for proving intelligence (or their engineering identity) encourages engineering students to build their image. Engineering women think they are intelligent and competent to be an engineer, however, by experiencing engineering school life, they seek the ways to present themselves smart and competent.

One the other hand, sometimes competition was reframed as an efficiently institutionalized process to select the "best persons" who could perform the engineering.

Diana: Umm...I think again it comes back to the fact that it's a whole rush in the engineering school to get you the knowledge you need to graduate, to perform this job. So, a lot of times, it seems like with engineering school, they're not going to take a step back and try to help you. They're just trying to get the best people through the program the fastest possible way...its kind of like an efficiency thing. [Undergraduate senior, Civil engineering, Asian American]

Diana's narrative shows that competition amongst students is justified because it is the "efficient" way to select people who successfully get through the mechanism. Competition is constituted through interaction amongst students as being supported by the idea of system efficiency.

Who Is Going to Be a Winner?

The emphasis upon the superior "intellect" of an engineer, coupled with the competitive structure, emphasizes the evaluation of the engineering identity and their own behavior. The women mention how they re-evaluate their competence and quality to be engineer.

Chu: Do you ever feel you are different from other engineering students?

Bunny: Yeah, I think everyone is different...but umm...yeah, I do just because I guess sometimes I feel, like I tell you, I'm sitting there and I'm like 'I'm never going to be able to do this.' And the person sitting next to you maybe like they understand it perfectly, and it's intimidating because you have people who are so bright, they understand everything, and I'll sit there and I won't understand anything that's going on right now and I do have to work twice as hard as the guy next to me to get the same grade. At times that is really intimidating and sometimes its like...no matter if I do good on the test it's such a let down to me because I put so much work into it and I just think that I'm not as good as anyone else because they can do it with no effort and I put so much effort into it and don't even get half as good as they did. So...but then there are different levels, because at times I may be...a little, not above up, I'm not above anyone, but I may think I'm a little smarter than someone else because they don't apply themselves as much but at times, my other colleagues, students, classmates, whatnot, they intimidate me more because they are...sometimes I feel inadequate...I don't feel I'm as smart as they are, but that's another thing too.

You always have competition, not just in engineering, but in engineering though, it's all your brain, like its not physical, its not acting, it's all what you can put on paper. That's kind of scary because if they put a math problem in front of you and you don't know it...YOU DON'T KNOW IT!...it's not like any logical thing that you can put down. [. . .] I think it's just in my major but, they're definitely competitive. I don' know...I think it depends on the person though, but if its related to engineering, maybe engineering would drive a person to do that because you put so much into it and its such hard work that you want to do better than the next person. I don't know....but it definitely is competitive. [Undergraduate junior, Petroleum engineering, White/Anglo American]

The competitive aspect of the engineering school influences the feelings of self-efficacy. Bunny said she sometimes felt she was not as smart as other engineering guys and it made her feel “inadequate.” This inadequate feeling is basis to differentiate her from “them” who appear to be understanding the materials perfectly. She thought she was supposed to be “above” anyone or do “better than” the next person, and not meeting this standard was “scary” and “intimidating.”

Feeling how she is different from “them” was disconcerting, but, at the same time Bunny justified it as an old tradition of engineering institutions. This competitive aspect of engineering institution has grown up out of particular beliefs: that the ability to do science and engineering as a “calling,” and that those who possess it are stronger and superior than those who do not (Seymour and Hewitt, 1997: 116-117). Thus a large entry of members should be reduced and flunked through competition. Through competition, students prove their quality to be a legitimated engineering community member. Furthermore, pitting one's intelligence with others is an important procedure to differentiate “me” from “them” or “legitimate member” from “illegitimate members.”

Presenting themselves as adequate and legitimated members pertains to not only the test scores but also by performance, as addressed by informants earlier. The guy sitting next might not understand perfectly the class material, and he might cloak the fact that he did not understand it and his feeling of “inadequacy.” But for engineering women, as a neophyte who run into the field traditionally not reserved for them, it is not easy to be relieved from the feeling of “inadequacy.”

Emma: I considered leaving engineering myself. It’s just you get, I get tired of constantly fighting, openly fighting, because you’re always trying to make a statement, always trying to be better, you’re always trying to succeed to be better than others and it takes an extra effort...and sometimes you say, ‘ok, is this worth it?’ [PhD. Student, Civil engineering, Mexican]

To survive in competitive engineering, women engineering students put forth extra effort to prove they are qualified. For women engineering students, obtaining the highest GPA is usually the only way to prove they are qualified to be members of engineering community, and this drives women to sometimes be even more competitive than men.

There was an interesting recognition of “more competitive women.” Even though the competition for the higher GPA seems to weigh equally upon everyone in the engineering school, some women engineering students argue women are more competitive even within their own group. In the focus group meetings, participants talked about how women were more competitive than guys over GPAs. In this group, composes of Chris, Thelma, Elena (Blacks, Undergraduate seniors), and Sue (White, Master student), Thelma addresses the issue of competition first:

Thelma: I believe that. I think that we do not show it but that we are way more competitive than men. Think about how hard we are on our weight. [Undergraduate Senior, Black, Group1]

Chris: In what area? [Undergraduate Senior, Black, Group1]

Thelma: In a lot of areas. I'm serious we are more competitive than men. [Undergraduate senior, Black, Group1]

Elena: With each other. [Undergraduate senior, Black, Group1]

[. . .]

Sue: I think academically a lot of girls are a lot more competitive, because guys (are) more lackadaisical. [Masters student, White, Group1]

Chris: I think that is a front for guys. [Undergraduate senior, Black, Group1]

Thelma: I think guys are competitive, but you see guys that will say I have a 2.2 but I am still going to get my degree, and that is the attitude they have. You do not see too many women in engineering saying that, you do see me cause that is me. I am telling you they (women) are secretive about things they are very competitive. They will not help you out. I am telling you what I have experienced. [Undergraduate senior, Black, Group1]

Elena: That is a good point. Females do not help. [Undergraduate senior, Black, Group1]

Thelma: Men will stop and help you if you ask, some of them, not all of them. I am just generalizing. Women are a whole lot more competitive than men. [Undergraduate senior, Black, Group1]

Sue: That is true. You are both right. [White, Master student, Group1]

According to the members of this focus group, engineering men did not care about their GPA because they knew they would graduate and start professional engineering careers regardless of their GPA without any social barriers. However, engineering women encounter different situations. As shown in the focus groups quotes, women compete with other women not men.

Chris: Probably you will help a guy before you help another girl, because we are not really competing against that guy. [Undergraduate senior, Black, Group1]

Thelma: That is sad. We need to take a look inside and do something about that. [Undergraduate senior, Black, Group1]

Sue: I have this one class. It is one of the only classes I really spend a lot of time on lots and lots of homework and working out problems. I have homework and reading and things like that in other classes. It is the only class I have it is like a math class there are just lots and lots of problems to work out. I think about

the people I work together with and it is me and this one guy and we always work together. There is this other guy and girl and they work together. I think of another guy and girl and they work together. It is interesting. I am friends with those girls. Every once or twice we get together to go out we should get together and try to do our homework, but we just never do it. Maybe it is just we do our work not at the same times or we wait till the last minute, or neither one of us know how to do it and we need help from other people. Maybe it is not that we are competitive, but we do judge each other girl wise a lot differently than we judge guys. We look at each other in different ways and we check each other out. Guys check us out but they check us out in sexual type ways. We check each other out to see is she prettier than me or is she smarter than me. [Masters student, White, Group1]

In the above discussion, the women examine the stereotyped notion of “women competing against women.” Here there is an extra dimension of competition: not only is their competition in terms of looks (and “weight” as mentioned before), but there is competition in terms of GPA. Through competing against each others, engineering women embody the legitimated conception of what engineers should be. To achieve visible success (GPA), engineering women may not necessarily compete directly against guys.

This also reflects that how organizational context of engineering is strongly constructed by male-oriented ideas about engineering. Women have been considered lacking in the genius for science-based professions, and they have been believed to succeed in other settings not requiring scientific qualities. Engineering women are placed in the field challenging their genius, so they more actively adopt the idea of engineering identity or work harder at it. This induces another competition within women’s own group.

If women engineering students compete directly against male engineering students, they know that they cannot win the game. They cannot succeed at being more “masculine” than the men in engineering. But if they compete against each other within a women’s group, they contest each other for the status men have defined as legitimate. Through competing against other women, engineering women reconfirm the limited conception of engineering, which pertains to particular values – hands on, physical, strict, not allowing deviation and flexibility, and thereby masculine.

4.1.3 The Manly Engineering: Constructing the Masculine Engineering

Does engineering have a gender? Science and technology-based fields have been stereotyped as masculine, not only in the person of their practitioners but in their gendered characters (Schiebinger, 1999; Connell, 1995). The great majority of engineers are men, but it is not the only reason for making engineering masculine. The association of gender and engineering refers to the culture of engineering and the situated-ness of women in the society.

On the one hand, society has normalized certain roles as female, which usually pertains to taking responsibility for others’ emotional well-being. Socially and culturally defined sex roles are legitimated through everyday practices and encounters women experience. On the other hand, engineering and engineers, as based on science, are expected to have certain attributes, which are usually connotative of masculinity. In an earlier section, I presented women engineering students who described engineering as “hands-on,” “practical,” “problem-solving and applying,” “strict,” “precise,” and “functional.” They defined engineering in seemingly gender neutral terms, but the

symbolic meanings of those terms are related to particular gender attributions. As Connell (1995) argues, the guiding “metaphors of science” research, the “impersonality” of its discourse, and the structures of power and communication in science stem from the social position of men, who are dominant in gendered society (Connell, 1995: 6).

Engineering Is Maintained by Men

Women engineering students recognize how engineering is organized by men in various ways. Earlier, I considered how they discussed how engineers are expected to be rational, unemotional, driven by recognition from peers, and highly competitive. In this section, I consider how women engineering students show actual practices or encounters they experience which make engineering masculine or “manly.”

While she was talking about her future plans after graduation, Diana mentioned balancing between family and work:

Diana: It (balancing between the job and family duties) is kind of hard because, you know, you look at the lists, they have these lists ‘best companies to work for if you’re a woman.’ Engineering firms are usually not on the list because, and it’s kind of understandable because 90% of your work force are male. You don’t have a lot of problems with females, females wanting maternity leave. Sometimes I know, ok, for example the consulting firm I worked for this past summer, all the female employees other than me were secretaries. There was one part time consulting female engineer that worked there. She was a part-time position and I was an intern, and that was it, and everybody else that was a girl was a secretary or accounting...administrative roles. So it is kind of different. [. . .] Because he has no concept, you know, he’s never had to do that before. She was probably the first person to come up and ask that (maternal leave). [. . .] So, I mean...a lot of it is just the fact that it’s a real mood thing for this industry, I think...but I think that they’re doing a real good job adjusting because more and more there are female engineers in the workforce. But, you know, it’s a little different because you are in a place where not a lot of people are going to understand about work balancing because most of them are the breadwinners, the family kind of guys. You know, it doesn’t matter how long they work, they have someone at home taking care of all other stuff. [Undergraduate senior, Civil engineering, Asian American]

Engineering is a men's field not only by the number of practitioners but also by the cultural and social practices maintained by men. Diana's account emphasizes the situation women encounter in a male-dominated work place such as an engineering consulting company. She stated it is "hard" if you are a "woman" in this situation. She experienced gender as a segregated work force and gendered occupations – women are secretaries, men are engineers. Diana analyzes women's difficulty in the engineering corporation with connecting the atmosphere ("a real mood thing") which is not dealing with women AS engineers. Through her narrative, she also demonstrates how the atmosphere of engineering work places and women's difficulty are related in the basis of the conventional idea of men as "breadwinner" and women as housekeeper.

"The mood" in engineering is constructed with invisible and visible practices:

Chu: Is there any advantage of being a man in engineering?

Maali: Yeah, I think so. I think that they, that the men in engineering, I think that they have their own way of talking and their own code and the way that they do things which is true. They've had, I've watched a videotape about the way men and women talk in industrial settings and everything and it's true that they do kind of have the meeting before the meeting and everything. So I feel women are kind of left out from that unless you're higher up or know how to get into that circle So they do have that advantage, I think...just by being male and a lot of them don't see it. They don't see that it's there that they have it. [Ph.D. student, Chemical engineering, Black/African American]

Maali emphasizes "the way" men think, talk, and behave and how "their ways" given them as "advantageous" status in engineering. The "code" or the way to think is not obvious behavior but, as a cultural practice developed by socialization experiences, it powerfully governs the engineering atmosphere and "leaves out" women. Maali also addresses actual behaviors men engage in that supports their dominant position in

engineering, such as having their own meeting before the meeting. Diana makes similar points:

Chu: Why do you think there is a high dropout rate of girls in engineering?

Diana: Lack of support... [. . .] Not having any other girls...for example, if you're in a group of people and there is twenty-five percent of girls in engineering and you're in a group of four people. It's mostly likely you and three boys, maybe they'll sit there and do their homework and when they take a break they'll be like 'Oh, did you see that baseball game on TV?' and maybe you're not interested in sports so you don't have anything to talk to them about...so it's just that ...they're acting all buddy buddy, you know, chum...you're not really with the group. So I think they feel like, 'Oh when you come to college you make most of your friends in your classes.' It's kind of a lonely feeling in the beginning when you feel that 'I can't bond with these people' [. . .] [Undergraduate senior, Civil engineering, Asian American]

Through "acting buddy buddy," male engineering students build a bond and they become "chums." However, even though studying together, women cannot go into "their" bond and consequently feel "lonely."

During their interviews, women engineering students often discussed the "odd relationship" with guys. Men and women engineering students study together and work for the group project, but women "are not really with the group," as Diana said. Sometimes women in engineering experience more than "male buddy buddy." They also encounter discriminative experiences regarding their gender. Bettie said:

Chu: Do you ever have any difficulties in the engineering school as a woman?

Umm...class size, a lot because it seems the bigger the class, the less girls that are in it. Like I was saying, you walk into a class and there's like 4 girls to 50 guys and so sometimes that's kind of hard. I haven't personally found any...well, with the exception of one, I haven't found anyone who, like discriminates or has any other thought of me just because I'm a woman instead of, you know, a white male engineer...hahaha. That's with the exception of my advisor, who I've heard doesn't like any girls, so I'm not really alone in that. He's the only one, and uh...I think it's because...that's just the way he was

raised, he's old, he was accepted to an institution which was only men⁴ and all that stuff. So he doesn't really, he doesn't really like women too much. He's not very friendly. He's the only professor, that I find, that won't answer my emails, but I have two advisors so I just go to the other one. All the girls started avoiding him because he's not helpful...so. [Undergraduate junior, Petroleum engineering, White/Anglo American]

Here, Bettie mentions it is hard to be a girl in a large engineering classroom dominated by male students. She provides an example an older White male professor who does not like women engineering students, and she perceives that his educational background makes him especially unfriendly to women engineering students. In her account of difficulties in engineering, Bettie stated that she might be discriminated against because she was a woman "instead of a White male engineer." She implies that white male engineer group is the dominant group in engineering.

It is not only older professors who women students describe as discriminating colleagues. In the account below, a woman student talks about dealing with male students in engineering:

Chu: How about your experiences with group work or team work?

Mandy: [. . .] he always kind of not let me touch the material, I don't know why. 'No, don't touch, I'll do that,' I'm like, 'Ok!' I find at first they don't ...it's like...either they don't really listen to me, they don't take me so seriously, because they don't think I know what I'm talking about, but as time goes on and we work more together and they see that I'm not stupid, I know what's going on, it gets better. I end up having great experiences. [. . .] Sometimes, I just notice that it's almost like...it's almost painful sometimes, getting it to work. It's like, 'C'mon listen to me, I can do these things!' or if I say something, I had it happen one time I said something and five minutes later another guy goes, 'Why don't we do this?' It's the exact same thing that I said. They're like, 'That's a great idea.' 'I just told you that five minutes ago!' 'You did?'...hahha It's just frustrating, yeah go ahead...I don't know, it's just frustrating. [Undergraduate sophomore, Electrical engineering, White/Anglo American]

⁴ Information was intentionally removed for the confidentiality.

Mandy perceived that she was not considered a serious engineering student based on the assumption, that as a woman, she “did not know what she was talking about” in engineering. She had to prove herself as an exception to the stereotype of the ignorant or incompetent woman.

The assumption that women are “foreigners” in engineering is related to the culture of engineering and the engineering identity. Maali recounted her consideration of leaving engineering programs and analyzed this by referring to the culture of engineering and the engineering identity:

Chu: Have you ever considered leaving engineering programs?

Maali: [. . .] But then like in graduate school I started to think about it (dropping engineering major) more. I don't know...it's just...sometimes, I guess, engineer just seems too rigid, or too formal or something.... With graduate school, too, I think that female numbers drop, they drop more than with undergraduates. You don't see as many females...haha [Ph.D. student, Chemical engineering, Black/African American]

Chu: (at the end of the interview) Any other comments about engineering?

Maali: Umm...no, not really. I really enjoy the graduate student learning community, they were really fun, I enjoyed them. I wish they'll be able to keep doing this for students keep learning about it. I thought it was really useful for me, to like, think about the culture of engineering. Why I feel this way, you know, it's not just in my mind, you know, it's different as a female. So, that was useful. I would encourage people to do that. [. . .] the culture of engineering, to me, is like very rigid. That's how I would define it. Very rigid and formal, you know, your professors, they all wear suits and everything all the time. I mean, other professors do too. It seems, I don't know, that they have to all the time, and you're just, you have to do your work, have to do it a certain way, set it up a certain way on paper, and it has to be neat and organized and everything. That's just pretty rigid and formal...not much deviation. That's just how I see it. [Ph.D. student, Chemical engineering, Black/African American]

Maali points out there are fewer women in engineering graduate school than undergraduate, and she tries to account for her feelings in terms of the cultural structure of engineering. She mentions the possibility of a connection between the culture of engineering school or engineering by itself and women. As women, engineering is “different” and the difference makes women feel uncomfortable. Maali describes the culture of engineering as rigid and not allowing deviation. But deviation in fact exists: women themselves are the deviants in the engineering subculture.

Women’s Social Situated-ness: It Is Not for Girls!

The notion that engineering is not for women is produced and reproduced through everyday practices and encounters that women in engineering experience. When they say they are majoring in engineering, when they meet non-engineering majors, when they study with other male engineering students, women engineering students find they are placed in the position in which they are “not supposed to be.” They first encounter the prevalent idea of engineering – and that they will be outsiders in this field – from their significant others, such as family or close friends when these important people respond to the decision of majoring in engineering in college.

Zena: My friends were really surprised, first of all because I was leaving my country, and there were like ‘well, this is great but it’ll be tough. Petroleum engineering is not exactly a girl’s field.’ But they were pretty supportive of me and pretty excited about it, I would say. Some of my older relatives, because I come from a kind of traditional country, they were like ‘this is not for a girl, you shouldn’t be doing this. You should do art or design or something, something for your soul.’ [Undergraduate junior, Petroleum engineering, Asian/Kazakhstan]

Zena was encouraged to study “girl’s fields” such as art or design not Petroleum engineering by her relatives, and she also received special reactions from her friends

since she was going to study traditionally considered male-dominated area. Zena (or her relatives) actually use the word, “soul,” and categorized art or design as about the soul whereas engineering is earthy or hands-on. Again, it reflects that women or femininity is artistic, not earthy, not rational, not practical and not an engineer. As a brilliant girl, she was supposed to develop her soul-side not practical skills dealing with real matters occur on the earth.

Bunny: She (mom) was like ‘Bunny, that’s not for you.’ My mom saw me as an actress. She wanted me to do acting. I was either going to do acting at NYU or engineering, talk about apples and oranges, but my mom just thought that I’m really competitive like with myself too and she just thought I was. She just didn’t really think it was me, and my dad was all about it. He’s a pilot and he thought it would be good and he just, whatever I wanted to do he was supportive of but my mom did not see me doing it at all, especially being a girl...she was like ‘Bunny, it’s not your domain.’ [Undergraduate junior, Petroleum engineering, White/Anglo American]

Bunny’s mother encouraged her to do acting on the basis of Bunny’s talent, but, this suggestion was not only based on talent but from her mother’s recognition of engineering was not good for “especially being a girl.”

Diana: She (mom) was saying, ‘it was a hard field to be in, you know?’ [. . .] when I started school my mom was always asking me questions like, ‘Do you like what you’re doing?’ I’m like, ‘I don’t know. I’m just in a math class this is not what I’ll be doing five years from now, its just a math class.’ She was always like ‘Do you think you’ll like it? If you don’t like it you should change.’ But, umm...you know, I’m just like ‘These are just intro classes, don’t worry about it.’ I mean, she’s still really worried about it now...she’s like, “Are you going to like your job?’ I’m like ‘I don’t know.....I’ll find out when I get there’...hahha. [Undergraduate senior, Civil engineering, Asian American]

Bunny and Diana encountered how their mothers, female adults who had more experience in the gendered society, responded toward their decision to major in

engineering. They receive the message indicating that engineering is “hard to be in” “especially for girls.”

On the other hand, women engineering students receive the “respected responses” from people in non engineering fields:

Zena: They were like ‘well, this is great!’ and just hearing the response from the people ‘whoa, that’s a really tough decision to make!’ I guess the challenge is really attractive, in the first sense and then secondly, it’s kind of like, you get this really respected response that you’re a girl first of all.” [Undergraduate junior, Petroleum engineering, Asian/Kazakhstan]

Zena explains the responses from the people about her engineering major in positive manner. She knows it is a “tough” decision for a girl, but this challenge is “attractive.”

Bunny: To a certain degree, I do think there is prestige being an engineer. When I meet people for the first time and tell them that I’m an engineer, they look at me differently, everyone always says, ‘no way, petroleum engineer, you?’ And I’m like ‘yeah.’ To me, it’s no big deal but I guess to other people it’s kind of like...they wouldn’t expect that from me...I think that’s a pro, just the title of being an engineer. [Undergraduate junior, Petroleum engineering, White/Anglo American]

Bunny also interprets other people’s responses positively. Being a woman engineer is “prestigious.” But she points out that their reactions are based on the unexpected connection between herself and Petroleum engineering.

Chu: Is there any advantage to being a woman in engineering?

May: I would say at this point...in, what’s the word...is it like...would you say, like political, social...the way things work, politically and socially in the previously male dominated thing...it becomes more of an advantage to be a woman because you stick out...people want to hire you because you’re a girl who’s made it...and it’s different...and, after everything that’s been said and done, “yeah, women can’t make it”...yeah, back...a couple of decades ago, “oh yeah, women can’t do this and that”, so now everybody is like, “oh, that’s stupid...girls can do it”, so it’s really more of a...when people see girls going

for it...it wins a certain respect, I think, so...and that's always cool...
[Undergraduate junior, Electrical engineering, White/Anglo American]

Women engineering students thought that they received respected responses from people because they were one of the few women in engineering at a prestigious university. This also means that engineering is not the profession for women, but, at the same time, women engineering students acknowledge that if they survive, they can “win a certain respect.” The paucity of women in engineering makes the women who do survive “winners” and worthy to be rewarded. This demonstrates the ambivalence of being a woman in engineering – possessing the disadvantage based on the stereotypes, and the advantage to have more opportunities if they survive.

However, to survive in engineering and to be winners, women engineering students report unpleasant reactions from other engineering practitioners, who have dominated this field for a long time, men.

Maali: [. . .] That's, I guess, the biggest thing that's difficult is trying to fix stuff or make stuff work because I know, one of my peers in my research group, he just loves to take stuff apart and put it together, he's always like, 'Yeah, we can fix this. I'll take it home and play with it, do stuff,' and I'm thinking 'Why would you do that? Why can't we just order a new one?' you know. So it's a different mindset, I guess, in guys versus women and the whole mechanical side of the engineering...as far as tools and equipment and things like that. That's the most difficult part, and then people see that too. They'll know that or assume that about you before hand, like if you're a woman, they'll assume that you don't know how to work things or that you don't know how to screw or unscrew things. Sometimes it's good because sometimes you really don't and they're willing to help you, then sometimes, you know, they kind of, you know, hold it against you or think that they have to help you, you know, they look at it negatively...so...
[Ph.D. student, Chemical engineering, Black/African American]

There are “different mindsets” in “guys versus women” and “mechanical side of the engineering” constitutes the culture of engineering. Maali sees the culture of engineering school as masculine and women having to adjust to the masculine setting. The burden of proof rests on women – they must demonstrate that they do not fit the stereotypes of being “non-mechanical,” and they must do it without appearing like they are infringing on men’s place.

Talking about the relationship with male engineering students, Mandy reported how male engineering students thought of female engineering students and how they are “threatened” by women doing engineering.

Mandy: Yeah, they’re threatened that the “little lady” can do their job, can do that just as well as they can. I don’t know why it should bother them, you know, they have no problem with what their mothers can do for them everyday. That’s a lot of work. I’m not stupid...I know how much my mom gave up and how much she gives for my brother and I. They have no problem for women to do those kind of things, but the fact that the little lady can work in the technical world and know what’s going on, sometimes really bothers them, it’s like we’re “infringing” on them....I don’t know... That surprises me because of the day and age we live in, hahhaah, I thought the 70’s were over, I thought we could do these things now and apparently I might be wrong...they’re still stuck in that mindset,...they don’t mind if you’re a business major, but...(they mind if you are in engineering). [Undergraduate sophomore, Electrical engineering, White/Anglo American]

When women do socially defined feminine tasks, such as mothering or housekeeping, men do not feel threatened because it coincides with the stereotypes. However, as Mandy addresses, men are threatened when they find women “infringe” on their areas. In other words, when the dichotomous boundaries of gender role are broken, when the gender roles are not congruent to the fundamentals (Heise, 1995), individuals feel threatened.

Many: Yeah, well they see it that way, I don't know. I'm not...I don't know how smart I am. But they definitely perceive it as one of the hardest, next to nuclear...double-e (Electrical engineering) and nuclear engineering are considered the two hardest, and I've been successful. So, they hear that and it frightens them. I don't know why. Some guys have a problem with seeing girls as intellectual people. It bothers them like that and they don't want to think...some of them just don't want me to be as smart as they are, and I'm not going to dummy myself up for anybody. Once again, that's their problem, not mine." [Undergraduate sophomore, Electrical engineering, White/Anglo American]

In this case, male engineering students feel threatened because, as noted by Mandy, they do not expect women to do engineering which is for men. Mandy is defiant in her approach and challenging men's expectations however, so while she recognizes the dilemma, she will not "dummy" herself in response.

In the emerging conceptualization, while individuals interact with other members of the organization, gender always stands out in the engineering school. Gender exists not only as distinct category for designating the status of an individual, but also as the on-going process constituted through everyday symbolic activities and practices.

As seen earlier, the gendered metaphors of engineering are continuously reproduced and legitimated through the cultural structures engineers practice everyday, and these metaphors benefit particular members of the engineering school context (Lederman and Bartsch et al., 2001; Keller, 2001; Schiebinger, 1999; Connell, 1995). The engineering school is gendered because "gender is present in the processes, practices, images and ideologies, and distributions of power in the various sectors of life" in the engineering school (Acker, 1992: 567).

4.2 Theme II: I am a *Woman* in Engineering; Struggling between Being a Woman and Being an Engineer

4.2.1 Women's Unique *Situated-ness* or *Locality* in Engineering

Individuals experience the organizational context differently depending on the unique characteristics of the organizational context as well as the social situated-ness of individuals in the context. This means that individuals experience the organizational structure, including the culture, power relations, obligations and rights attached to the statuses, based on the dynamic interaction between the contexts and the individuals.

Feminist Standpoint theories argue that women's *locality* or *situated-ness* is important for understanding the conflict, tension or deflection experienced by women in particular contexts. In this specific case, I examine how women in engineering school are continuously challenged to define and redefine the situation and themselves responding to their social situated-ness. Women's experiences reveal the organizational structure of the engineering school, and how the social order benefits some at the expense of others.

In this theme section, women's experiences in the engineering school are presented through survey results, autobiographic essays, focus groups meetings, and in-depth individual interviews.

According to the Engineering Academic Programs Office at the Texas A&M University, in Fall 2004, 19.8 percent of registered students including undergraduates and graduates are majoring in engineering programs (8, 808 out of 44,521), and 18.4 percent of them are women students (1,622 out of 8,808). As detailed in the previous chapter, 273 engineering students were surveyed during the Fall semester 2004, and 86,

or about 31.5 percent of the all respondents were women. 86, about 31.5 percent of the respondents were minorities and there were 12.5 percent of Hispanics and 9.5 percent of Blacks. 26 were minority women and this was 30.2 percent of all female respondents. The students enrolled were graduates (9, 3.3 percent), seniors (71, 26 percent), juniors (93, 34 percent), sophomores (67, 24.5 percent) and freshmen (33, 12.1 percent).

Regarding general experiences in the engineering school, the survey asked if engineering students enjoyed the courses associated with their majors; were satisfied with the quality of teaching in the engineering programs; were satisfied with the relationship with the faculty members in my engineering program; and experienced any difficulties in surviving the engineering programs.

Table 4. Gender and Experience of Difficulties in Surviving the Engineering Programs

		Experience of Difficulties			Total (N)
		No	Yes	N/A	
Gender	Women	29 (34%)	57 (66%)	0	86
	Men	68 (39%)	107 (60%)	1	176
	N/A	6	5	0	11
Total		103(37.7%)	169 (62%)	1	273

According to Table 4, out of 273, respondent, 103 said they did not experience any difficulty in surviving engineering programs. Women are slightly more likely to say that they experienced difficulty, but there was no statistical difference between women and men.

There were subsequent questions asking those who did have difficulty, the specific types of difficulty. To identify if differences in perceptions of barriers exist, the respondents were asked to choose the most important one(s) out of 8 different reasons – poor quality of teaching, poor relationship with faculty members, poor relationship with other students, lack of financial support, dissatisfaction with grades, dissatisfaction with workload and speed of progress, competition with other students, and lack of support from faculty. “Poor quality of teaching” was the most frequently chosen reason for difficulties, and “poor grades” and “hard work” followed. There was no statistically significant difference between women and men for any type of reason.

Of the 95 respondents who chose “dissatisfaction with workload and speed of progress” as the factor contributing to the feeling of difficulties, 37 (38.9 percent, the most frequently chosen reason by women) were women, while 58, or 33 percent of men engineering students chose it. The most frequently selected reason for feeling of difficulties by men engineering students was “poor grades (79, or 44.9 percent).”

Seymour and Hewitt (1997) argue that women are more likely to experience difficulties with relations of professors and the “climate” of science and technology-based academic fields (Seymour and Hewitt, 1997: 235). This survey also shows that women and men have different kind of difficulties in the engineering school. Men’s most frequently chosen reason pertains to the individual reason – poor grades; women’s most frequently chosen reasons for difficulty are more related to outside factors – assigned heavy workload or speed of progress.

However, there is a significant difference by classification. Of 169 respondents who said they found difficulty in completing engineering career, 56 (about 33 percent) were juniors. But, about 73 percent of all seniors said they had difficulties. So those in more advanced classes were more likely to say that they experienced difficulty in surviving engineering programs ($P < .03$).

Table 5 shows how often the students had considered or attempted to leave the engineering programs since they had entered. Gender is statistically significant (Chi-square probability < 0.04). Women were more likely to say that they thought about leaving than were men.

Table 5. Gender and Leaving the Engineering Programs

Gender	Leaving the Engineering Programs					Total (N)
	Not at all	just once	sometimes	very often	N/A	
Women	24	28	24	9	1	86
Men	76	53	31	16	0	176
N/A	3	7	1	0	0	11
Total	103	88	56	25	1	273

33 out of 85 (38.8 percent) women respondents have considered leaving their engineering program more than once, while only 26.7 percent of men respondents have thought of leaving.

As discussed previously, women's attrition in male-dominated fields may have various and complex reasons, but it should be considered in terms of dynamic interaction between individuals (women) and the organizational context. Women engineering students experience the engineering school (the organizational context of the engineering

school) differently from male engineering students because women are situated in a context in which they are constantly told that they are outsiders.

Teri: I think it's something that's hard for women in engineering to do, to ask questions in classes. I mean, for me, it is...I don't like to ask questions in class but if you can't do that go after class, talk to the professor (and) make sure the professor knows who you are, make sure the professor knows you're interested in doing this sort of thing. I mean everyone has their preconceived notions and professors do too. They might think, they might think a lot of women coming to engineering, you know, they're not really serious about it. I mean there is an attitude, there is a joke running around, but there's always truths to jokes, you know, women are just in engineering to find a husband, you've heard that I'm sure. And people say it and they laugh at it, but some people actually believe it. And when everyone says it...this is something about me being on the defensive. A lot of people will say, 'Well, that was just a joke,' but if someone says that joke I begin to wonder if they really believe it, and that is something that if I weren't outnumbered 20to1, I wouldn't see...or I wouldn't feel, you know...but because I'm outnumbered, you know, those little things make a big difference. [Ph.D. student, Nuclear engineering, White/Anglo American]

Engineering women encounter situations in which they are constantly "outnumbered." Engineering women feel invisible in engineering (that is why they should make sure that their professors know who they are), however, at the same time, they are visible to male engineering practitioners as women. Engineering women are believed to be on the path to becoming someone's wife not a serious engineer. Identified primarily as women rather than engineers leads the women to feel strange and this influences the development of sense of self as engineers.

How women experience the organizational context of engineering school will be discussed by presenting their stories. Women's stories and narratives show the dynamic interaction between what women are expected to do and be "as women" and what

women are expected to do and be “as engineers.” These expectations often clash causing stress in the identity formation and subsequent behavior.

4.2.2 The Social Situated-ness of Women

Women’s situated-ness in engineering becomes apparent when women confront the situations, which coerce them to define and redefine who they are as *women* engineers. While interviewed, women engineering students often said the engineering school was “challenging.” There are various reasons for defining engineering school as challenging. Course work keeps students busy, the heavy workload makes them exhausted, and class materials seem tough. However, women engineering students mentioned more than just the weed-out courses, heavy assignments, or tough math problems. They often stated (albeit in different ways) they felt that many believed them to be invaders from “other” arenas.

Being perceived by others (and sometimes their selves) as invaders from other arenas is, in part associated with their socialization experiences and the cultural perception of woman. Through socialization processes and cultural expectations of women, women’s social situated-ness is developed. However, the women’s social situated-ness often conflicts with what is expected for engineers in the engineering school. The focus group discussions and the individual interviews demonstrate how women’s social situated-ness conflicts with their engineering situated-ness.

Sue: So it is very different you see yourself having trouble relating to people and I think that this is a lot of it. You have to be strong to get through it and this is what I am facing. How...I guess, I am kind of beating around the bush. It seems that support system that you don’t always have, and it looks back to that, and that there are so many guys. [Focus Group1, Graduate master student, White/Anglo American]

Talking about their situated-ness maybe “beating around the bush,” ambiguous, and obscure. Women “have trouble relating to other people” in engineering and, as Sue points out, this trouble seems to be from the scarcity of women in male-dominated context.

Women engineering students think they are “different” from other engineering students because a majority of engineering students are men. The number makes them a minority, and influences how they think of themselves as engineers. It is not an unusual experience to be the only one woman in a large classroom, this alone evokes the salience of gender.

What It Means to Be a Woman: Sex Roles

Society, parents, friends, professors and male colleagues view engineering as “not a women’s area.” All of the women engineering students said their parents supported their decision to major in engineering in college, but invisibly and unconsciously, and sometimes blatantly, engineering women received the message that they were in the “wrong” place. This message comes from or through the women’s experiences and their socialization, and the message is reproduced through women’s narratives about it.

Chu: Some scholars argue there are few women in engineering. Why do you think it is the case?

Eli: I think that little boys in our society are socialized to like things like construction, to like things like math and science, and computer programming. Little girls are socialized to like things like the language arts and domestic skills, child care...forming relationships, things like personal or international diplomacy women do really well. And part of this, I’m sure is because, I think parents and teachers and society in general unconsciously socializes people to go this way. [Ph.D. student, Civil engineering, White/Anglo American]

Nikky: What I said before is that girls just fold under the pressure. They fall out a lot quicker. The real thing is, I think it has to do with the culture of our society, you know, all that crap you see on TV and you see in movies, you know, women tend to be shown in more traditional women's roles, you know, as educators and caretakers and things of that nature. Also, women can get a bad message from their families or their families' culture. If their family, say the women of their family has a long standing tradition to say, be homemakers, well then they're going to be more inclined to follow the footsteps of their mothers who's followed the footsteps of the grandmother and so on. It's just the message that today's society puts out. There aren't, they don't really encourage...they don't actively encourage women to go outside of the traditional gender roles. There is nothing active that says, "women, be engineers" or "women be math majors" or "be physics major" or "think outside the box"...no pun intended on that last one. [Undergraduate junior, Aerospace engineering, Hispanic]

There are different cultural expectations for men and women, in this case, especially for the professions. Women are not forbidden to do engineering for their career, but they are also not encouraged to do it. As Eli and Nikky stated, women are actively encouraged to have careers in "feminine" tasks, such as mothering, caring, nurturing, and educating.

Consciously or unconsciously, women conform to the socially constructed idea of gender and sex roles. Diana addresses the social pressure for women to follow conventional sex roles:

Diana: I think part of the reason why there are fewer girls in engineering is because at some point if you don't keep pushing them and they want...especially when you're a younger girl, if you think about people thirteen to fourteen, high school age, it's really important to fit in. It's just that age where you want to be like everybody else. [. . .] I think a lot of it comes from the fact that there are more girls who want to be like their mothers and traditionally speaking women have these 'woman role' jobs like; secretary, administrative, education. If they want to be like their moms, if their moms are their role models, then they'll go that way...just because of the way society has been in the past. [Undergraduate senior, Civil engineering, Asian American]

As Diana points out, history creates the status quo and so when women choose paths different from the past (do not “fit in” the expectations), it can be considered deviant. The social expectations about genders are strongly represented in everyday routines and cultural practices. To the question of why there are so few women in engineering, Julia stated the gender stereotypes played the significant role:

Julia: I think, it just all goes back to the stereotypes. [. . .] There was this art teacher who was overseeing it and she told the guys, ‘ok, you guys can do the technical stuff with the projects and you girls, you can do the writing and the art,’ so automatically she separated us and it really made me upset, but I think it happens to us a lot when you’re in high school. I think boys are just automatically assumed that they know how to do the technical stuff and they always leave the creative stuff to the girls. So, I think it’s just something that happens in high school and just moves on so girls get this impression of, ‘oh, I hate math, I can’t do math,’ and that’s why I think there are fewer of them in engineering. [Undergraduate senior, Civil engineering, White/Anglo American]

Mandy: [. . .] When I was in 7th grade, no one (encouraged me to take sciences classes), guys were more encouraged in science classes and math classes. I noticed that, I don’t know why, if looking back at it that bothers me. I knew what was going on and why didn’t anyone ask me to do it..hahah. They’re more encouraged to those professions, girls aren’t. And I think if you could encourage girls earlier on so that they went into it knowing they wanted to go into it. [. . .] [Undergraduate sophomore, Electrical engineering, White/Anglo American]

Through socialization, the conception of gender is constructed and individuals learn to perform “appropriate” sex roles. Parents and other family members are important sources of information, but as stated in the narratives, school is particularly relevant because it is here where “talent,” “skills” and “abilities” most relevant to career choices are emphasized.

Acknowledging the socio-cultural expectations for genders and sexuality, women engineering students feel that they are distanced from expectations. Media representations are also cited as sources as generating certain expectations.

Chu: there are few women in engineering, why do you think that's the case?

May: Honestly, I don't know...ummm...it's just not something that they've always done. I think they tend to like the more...ummm...the more traditional roles, you know, being a businesswoman is very popular right now. You see, on TV, and TV has a lot to do with it...ummm...on TV, you see women that are either powerful business women or they work as clerks, secretaries, you know, blah, blah, blah...and women that are engineers are kind of rough around the edges and they're kind of...they're reclusive, they have odd relationships with guys and it's not...it's just not...it's not sexy...I think that's why, so... [Undergraduate junior, Electrical engineering, White/Anglo American]

Doing engineering challenges women by placing them in the “odd” relationship with guys and by making them “reclusive” and “not sexy.” Engineering women have “odd” relationships with men because they are women, who are doing men's tasks in men's arena.

By deviating from the socially suggested sex roles, women engineering students often receive the specific messages that they are being “uppity” or too proud relative to men:

Chu: Scholars argue there are few women in engineering, why do you think that's the case?

Eli: [. . .] I was taught, and not overtly taught, to get the idea that it's not okay to be overtly intelligent...to be better than all the boys in your class, particularly in something like the math and sciences, which is seen as a male thing. I think that maybe girls who go into engineering don't stay because when you say, ‘Hi, I'm Eli and I'm a civil engineer,’ an image pops into somebody's head. When people say, ‘I'm a PhD student in civil engineer,’ the first reaction from everybody is ‘OHHHHH.’ And I don't really like that very much [. . .] [Ph.D. student, Civil engineering, White/Anglo American]

Some informants account this same kind of experience as a respectful response from others, but Eli points out that those “wow” responses are due to her violation of cultural expectation about girls in the profession.

Referring to the cultural expectations about genders, compared to women, male engineering students are assumed and are expected to succeed in science, math and engineering.

Chu: Is there any advantage of being a man in engineering?

Mandy: Yeah, people take you (men) more seriously. That’s the biggest thing. They expect you to succeed. They, I think, they know you will succeed. No one looked at me and said, ‘I know you can get through it,’ my dad did and my mom did, but they’re not here at school...no one at school did that. The first day in class some kid told me, I only had two weeks...hahaha...an overwhelming vote of confidence, you know. No one expected me to succeed, no one expected me to pull through. They expect, they know the guys will. That’s the biggest advantage. Having someone believe in you is the biggest thing to have in your corner. Biggest advantage you could ever hope for. Girls don’t have that, they don’t receive it. I don’t know why, but I think guys...to me, that’s the biggest thing. [Undergraduate sophomore, Electrical engineering, White/Anglo American]

Chu: Do you ever feel different from other engineering students?

Teri: I do feel different...umm...because like when you first start out in engineering, I think, and someone sees you’re a girl in engineering...they expect you...they don’t, they don’t have an idea...they don’t know if you’re going to make it or not, so from the very beginning you’re tested, you know, from...in the eyes of public opinion, so to speak, to see if you’re going to hack it or not, but for every guy engineer in the class, people assume that they’ll probably make it and that’s the distinct difference I’ve seen. I’ve been to two universities and I’ve seen it both places. [. . .] [Ph.D. student, Nuclear engineering, White/Anglo American]

Women are not expected to be intelligent in math, science, and engineering, whereas men are easily assumed to be able to succeed in engineering. Mandy and Teri experienced skepticism by others about their ability to succeed. These expectations, in

this case of women, expectations for failure, create their own reality. And as Mandy notes, having people believe in you is the biggest advantage you can have, and “girls don’t have that.”

Men also are given more chances to expose themselves to the science and technology sites, and learn engineering.

Messina: The only thing I can say is that I think a lot of male engineering students they have had exposure to the engineering field before coming. In terms of maybe their father knows somebody or somebody in their family is an engineer so they have actually seen them work. Or maybe they have been able to shadow one of their, you know, persons that they know, and I think that gives them an advantage. And maybe, I might be a girl in the same family and I haven’t had that exposure or maybe I might be a female and I haven’t had any of that exposure. [Undergraduate junior, Civil engineering, Black/Caribbean]

Mandy: Obviously I’m one of the very few girls. All these guys that took multiple physics classes in high school, they have all programs, their computer programs, (and) they built their own hard drives, I didn’t do that. Hahaha...I’m sorry, I didn’t want to mess it up, I didn’t want to be like, ‘Dad, I broke my computer,’ hahahah...that would be bad. It’s just not something that I’ve done. I found that when I came in they expected me to have done these things. They talked to me like I should have. What made me the most frustrated was the fact that I came to college to learn these things. I didn’t come to college for them to tell me what I should know, you know...I’m paying ‘how much money’ to sit here, so you can teach me and I can have an education to know how to do these things. That was the biggest...the biggest expectation that I saw that they had of us and I still see it sometimes. It’s not so bad now. As you get higher you’re more on an equal level, because you can’t, obviously you cannot do all these things except what they teach you. That was a little (inaudible)...so, that’s the biggest expectation I’ve seen. [. . .] [Undergraduate sophomore, Electrical engineering, White/Anglo American]

Different gender expectations created through early socialization processes have ripple effects. Because women have not been involved in engineering type activities (like building computer hard drives), they lack the experience that most men have. In turn, this lack of experience causes others to evaluate women negatively. Thus gendered

expectations are produced and reproduced through their interactions. And, in these instances it negatively affects women.

In their study on the computer science students at the Carnegie Mellon, Margolis and Fisher (2002) find that about 70 percent of women computer science majors say they are different from the majority of their peers and assert that their lives do not revolve around computers (Margolis and Fisher, 2002: 67-68). Margolis and Fisher make a point to that women computer science majors feel excluded from the “computer geek culture,” because they do not a great deal of formal and informal computing experiences to have the “magnetic attraction” that male computer science majors have (Margolis and Fisher, 2002: 40). Prior computing experience can also have significant impact on confidence and comfort, and give the impression to many women that “others catch on so much more quickly. (Margolis and Fisher, 2002: 80).”

The social expectations about women sometimes lead to overt discrimination.

Elena: I think one thing with what you were saying, not saying what I want to do with the rest of my life, but professors should realize that there aren't very many of us and when we ask questions they should take us seriously. I know I do not appreciate it none what so ever when I ask a question and the professor laughs and the class, they want A's, so they laugh too. You want to know the answer to my question just as much as I do, so why are you laughing? Then the professor will not answer my question he will just move on and say something like why don't you see it, it's there. [Focus Group1, Undergraduate senior, Black/African American]

Nikky: Well, sometimes it's annoying when my group, team members, are stereotypical...that really, really annoys me. It happened one time, it really pissed me off, (it) was when we had to build a rocket, and we set team meetings, we did everything, we decided what we were going to do, who was going to do what, then it came time to build it. So, everybody was doing fine until we had to build it and then we were going to be at this place so and so was going to pick so and so up and take them over there but, they conveniently forgot to pick me up. They left me out of the building of it on the basis that I didn't know how to build

a power tool, when I do, but they assumed I didn't and therefore left me out of the building of the rocket. That was very annoying, I got really pissed at them but other than that there haven't really been any difficulties, for me, mostly because I've proven myself. I prove myself to my teammates by, you know, understanding the material and being able to answer questions and doing all my work and having all of it done right before the deadline. It's like they know I'm a good engineer and I'm going to do my share of the work, that they can rely on me. There's another good word. A good engineer is reliable. That's a very, very good word. You have to be able to trust them and to rely on them to do their share of the work. For the most part I haven't really had a problem because I am respected. [Undergraduate junior, Aerospace engineering, Hispanic]

In engineering school, women students suffer from the stereotypes related to lack of experience and knowledge about engineering material. As shown in Elena's account, engineering professors, who are usually men, ignore women students' questions and do not take them seriously (Seymour and Hewitt, 1997; Margolis and Fisher, 2002). Other engineering students, who are predominantly men, were supporting the professor's attitude toward women by laughing together, thus creating a bonding of men against the outsiders, women.

Nikky also talks about her experience with the project team members. She was left out from a specific part of the work by other team members because of their assumption that she could not do the task. Nikky thought the only way to overcome the stereotypes was to prove herself by performing better than others. The socio-cultural assumption about women was reconfirmed and consequently forced her to "prove" herself.

What It Means to Be a Woman: Our Different Career Paths

Cultural belief about genders plays a significant role for women and men in the choice of career (Correll, 2004; Reskin, 1993; Acker, 1990). Women are socialized to

perform gendered roles or conventional feminine roles, and women in engineering have chosen a “different” career path.

When asked to describe their future after graduating from college, the women showed much concern about dealing with family duties while working as engineers. To get balanced, they were seeking some “flexible” positions in engineering:

Bunny: I mean I’ve thought about that. I want to work, just to make enough money but I don’t know who my husband is going to be. If he doesn’t have enough money, I’m going to need to work but ideally, I would like to work long enough before I have kids to make enough money...just to be, you know, substantial and what not and then I wouldn’t want to work. But that all depends, I mean, if I have kids I think I would want to stay at home and raise them because my dad was never at home, I mean, he was a pilot and everything. So, coming from that I would definitely want to be around my kids as much as I could. And I don’t think I would, I definitely won’t want to do field work, I’d probably do an office job after I have kids. [Undergraduate junior, Petroleum engineering, White/Anglo American]

Messina: Yeah, I would like to get married and have children, but sometimes I feel as if...well, it depends. I know there are different tracks you can go. Management track in engineering or the technical track. Management is that you need more procurement and trying to get projects and so on, and technical is the actual design and going out into the field. Sometimes I feel, you know, being an engineer...I want to have a family, I want to get married and all that, but how do you work it out? [. . .] Now, how, how am I going to be able to, you know, have a family and make sure that my children need to be looked after and have these types of, you know, job responsibilities? So, I think it can be done, but it has to be worked out. I don’t know how...sometimes it seems to me...when I envision it work, that it would be difficult for me to balance that, but, I do want to do that, but I’m thinking I want some actual working before I get married, you know, so it can balance out. [Undergraduate junior, Civil engineering, Black/Caribbean]

Teri: I mean obviously, having kids is going to slow down your career...it is...you have to, I mean, you’re going to take off six weeks in maternity leave...six weeks...a lot can happen in six weeks. You’re going to be worried about the kid, you know, like ‘Am I screwing up the kid by not staying home?’ if you decide to go back to work. So, it’s a tough decision, it really is, it’s hard, and you know that’s one of the things that makes being a professor actually a nice job to have because as a professor you have a much flexible schedule, like, you can work from home if you want. You can show up just to meet with your

grad students and teach classes if you want, no one can tell you any different, you know. So you can stay home with your kids if you want. And so if I were going to have kids that would kind of be the preferred job to have, maybe...I don't know. That's rough...it's a tough decision, I mean, there's no easy way, you know. [. . .] Let me say this. I would sacrifice part of my career to have a family, if it came down to that, making that decision, I would feel that that would be the right decision to make...I would, I mean, I don't know...yeah...that would be the final, you know, the final whatever...that would be what would happen. [Ph.D. student, Nuclear engineering, White/Anglo American]

Maali: I don't know...I think part of it (few women in engineering professions) might be that the fact that the woman, you know, working in the industry, like they know, 'Ok, she might have kids then she'll leave the job,' I guess, like not really being dependable or not really being as career oriented as they are, you know, because they, you know, will be there all the time. If their child is sick or something, you know, they'll be there and their wife will take care of it or something, but a female, you know, she'll miss that day of work and stay home with a sick child and stuff. And I've seen, I think that kind of plays into it, in the back of their mind, the whole family thing, that they're more family oriented and that comes before their job and so...the fact that their job is... [Ph.D. student, Chemical engineering, Black/African American]

The narratives demonstrate that women have certainly thought about the dilemmas associated with having a family and a career. For the most part, they seem accepting of the gendered family roles. This is seen in their consideration of staying at home with children or sacrificing careers. For women engineering students, there seem different tracks for being professional engineers – technical and management tracks. Messina and other informants tell how women decide their career path based on gendered duties.

On the other hand, different career tracks for women are not always available to every woman. Furthermore, this career choice structurally reproduces another type of women's attrition in actual work places and the gender inequality in career choices.

Bettie: “[. . .] it’s also, I think, harder for a woman on that end, for petroleum engineering because guys can go out and they can be a rough neck or a (inaudible) on a drilling well...or like, on and out in the gulf of Mexico. They can actually go and field work on the drilling rig, and like they’re basically gofers and all the older guys that work, you know, just say, ‘Oh, go get this tool for me, go do this,’ but there is a really small percentage of girls who are willing to do that or companies that are willing to hire girls to do that. I know, personally, three guys that are doing that this summer, but that’s not an option for me. So, basically the only kind of internship that I’m looking, that I could look for is to follow around like a supervisor who, you know, goes to the drilling rig and looks at it, but, you know, actually...just the...it has a lot to do with the atmosphere on the drilling rig because it’s a bunch of old guys and they’re really raunchy and dirty because it’s only guys on the drilling rig. So, it’s seen as an unfit place for a woman...so...I’ve had guys that. My friends that have worked on a drilling rig are like, ‘You really don’t want to go because it’s not woman friendly,’ and you know, what can you say to that. If someone is not willing to hire you to do that and that’s the only open position...you have to go somewhere else. [. . .] because they (men) have more jobs they can do, they have more companies willing to hire them for those low level jobs, but for me I’m going to have to jump in at the higher level. [Undergraduate junior, Petroleum engineering, White/Anglo American]

Nikky: I think there is (the advantage of being a man in engineering schools)...which kind of sucks, but I think the professors like you a little bit more...hahaha...no, I’m just kidding. On a serious note, I think that the job opportunities are pretty good and that’s like the only difference I could see. That would be the main advantage, you have more career opportunities. [Undergraduate junior, Aerospace engineering, Hispanic]

Male engineering students have more options or opportunities or diverse career paths than women engineering students. Bettie mentions that there are some field work – such as working on a drilling rig, is not available for her. These kind of tasks are considered “masculine” by the society, and so are limited or blocked to women. Even if a few women do work in those fields, they confront the “unfriendly” work environment. Lower level tasks, dirty work, or hard core engineering is not easily available for women,

so women engineering trainees (students) think in terms of careers that involve management.

Doubts and Bended Intentions

Women engineering students receive information about professions, and, even though the message does directly pertain to sex categories, they see it as gendered because they recognize how women are perceived by the society and other engineering practitioners. Because this is the case, women often question or doubt their competence to be a real engineer.

Because of the cultural expectation about women and sex roles, other engineering practitioners, usually men, assume engineering women cannot succeed in engineering. Zena said:

Zena: Because you have to, it's like when you're a girl, you're supposed to be, either perfect. If you fail at least once in engineering everybody would tell you, 'Oh, you failed because you're a girl.' [. . .] As I told you, I want to be a successful engineer as well as raising a family. In general, women are expected to be more feminine, more family like to have a tendency of having a family. So, I guess, yeah, you have...the beginning of your career, especially school, you start thinking, 'do I really want this? Do I really want to sit here and be always competing with these guys who put me down?' Because you do face that (different expectation). I faced it in my internship. People don't really expect that. [Undergraduate junior, Petroleum engineering, Asian/Kazakhstan]

Being expected to be "more feminine" induced Zena to wonder if she really continued the engineering career. Bunny also said:

Bunny: At times I think that I can definitely apply myself elsewhere and do better...like, if you come into engineering and someone asks you like 'Who's the smartest person in your class?,' no one is going to say me. I don't take offense to that, I mean, I make great grades. I'm easily in the top 5% of my class but no one would say, 'Oh, Bunny is really good at this stuff.' I have the grades to show it but I don't know if people would characterize me as the

perfect engineer. [. . .] I think a lot of people do (drop out of the engineering school) because women are more diverse than I think are men. Men are like ‘I’m going to be engineer, whatever, make good grades, make bad grades, I want to be an engineer.’ We think a little more into things, I think...so, that’s my personal take on why I would drop out. [Undergraduate junior, Petroleum engineering, White/Anglo American]

Bunny’s account shows that how men and women react to the same situation differently. Cultural expectations about women makes women consider “diverse” options other than engineering, meanwhile, the gender expectation makes men stick to the engineering career regardless of the situation they encounter.

Eli: So if you encounter a setback in a field where you already feel uncomfortable, where you already feel like you don’t belong, I think you are more likely to let it dissuade you from sticking through it. There were times when I almost dropped out of engineering because the classes were really hard and I just didn’t think I had what it took to do the work. And I think...and I don’t really have any statistical backup for this, just personal observations, but I think that some of my male classmates felt that same way, but (they) were just sitting there thinking, ‘I’m going to stick with it. Surely sooner or later this will get better, I’m not going to allow this to break me,’ whereas I was a little bit more likely to lend it bend...you know, bend my intentions, my goals for myself. So this may also be why a lot of women drop out. Certainly we are not any less capable. I think that there is just side factors that apply to it. [Ph.D. student, Civil engineering, White/Anglo American]

Eli also sees how the socio-cultural expectations for gender influence individual retention in engineering school. Lower expectations for women give them the legitimated, socially proven excuse for leaving the engineering programs, whereas, male engineering students, who might be experiencing the same pressure don’t interpret the problem in the same way.

Bettie: [. . .] Also, you know, once you come to college...this sounds bad, but I know a lot of girls who come to college to get their MRS degree, their Mrs., .they just want to get married, you know what I’m saying? Yeah...so I think a lot of

girls that comes to college, it' sounds bad to say that but I've met girls who say they just want to get married and they don't want to work, you know, they just want to marry their husband, start a family, have kids and have their husbands work. I understand that, that's fine, but I don't want to do that. I want to be able to be self-sufficient, and...so I think a lot of girls, they find that, like the easier rode to take, 'Ok, I can be supported by my husband or go through all this hard work and trouble to be an engineer and be self-sufficient.' I think that's another thing it has to do with. When guys on campus, (guys) are like when they graduate they're the ones that are going to be supporting someone, so they are going to have to do something where they make good money and they enjoy their work. [Undergraduate junior, Petroleum engineering, White/Anglo American]

Socio-cultural expectations about women cause them to constantly reassess if they really want to be engineers.

Debra stated that engineering women were strongly influenced by gender stereotypes and this prompted low self confidence about engineering, and consequently led to women's attrition:

Debra: I think it's because there are so few female engineers within engineering and when you...when you're maybe the one female out of the whole study group and you don't understand a concept, but all the guys do, sometimes in the back of your mind you feel that you're not competent enough, like you're not...umm...like you're not able like them. And if you get maybe lower grades than they do, you know, that's very discouraging, especially if you're a girl who comes from a high school where you've been successful, you've had a high GPA and everything. And I think sometimes girls get discouraged because, you know, their competition is men and when you're already in that department it's just really hard to not think in those terms of, you know, the differences of the sexes, when it's just really people in general. And so...once that starts happening they think of other majors that maybe other girls are in that make them more comfortable, like education or business, psychology or sociology, and you know, that may be a better field for them, but I do think women, in general, do get discouraged just because they are around other men. And I think, I seriously think that if it were 50/50 it would be the same thing...like the girl wouldn't be discouraged because it was all men, she would be in a group with maybe like four guys and four other girls and she would be discouraged because they would understand and she still wouldn't. Do you know what I'm talking about? Sex does not matter...the sex does not matter...I just think there's just too few women engineer students so when a girl is in a group of all guys it's more

discouraging to that girl because it makes her feel that she is under...under them." [Undergraduate senior, Electrical engineering, Black/African American]

Debra's account clearly demonstrates the salience of sex category. When she is claiming that "sex does not matter," she is saying that it is not innate, but there are just too few women. But, what this means in the engineering context is that, indeed, sex (category) does matter. Gender always interrupts women's perceptions of themselves as engineers. Bettie made a similar point:

Bettie: Umm...all my friends...the one thing is there's not a lot of other girls in the class so when you walk in and there's 3or4 girls and like 50, 60 guys. It is really, what do you call it, not distracting, really intimidating because you know you have to survive with all these other guys and there's only a couple of girls that you can actually talk to and like, 'Hey how are you doing.' [. . .] I think, for girls, there's more of like, 'Oh, it'll be ok if you switch. You're doing really well anyways,' because most of the...you know, there's not a lot of girls in engineering. So, for you to transfer out it's still like, 'Oh, you were an engineer, that's still really awesome,' but for guys, I don't think there's that same leniency, basically you're going to graduate in the engineering field, they can't really wuss out and be like, 'Oh, I think I'm going transfer out,' you know. I don't think it would be seen as socially acceptable. But if a girl does it, it's like, 'Wow, that must've been really difficult for you. Congratulations. I'm sorry that you had to switch out of your major,' but, you never know...that's how I see it. [Undergraduate junior, Petroleum engineering, White/Anglo American]

The idea of "bended intentions" is related to the argument that women are less persistent in their careers than men because they can rely on the "socially sanctioned safety net" of marriage (Schiebinger, 1999: 59). As shown in Bunny's interview, women engineering students think they have diverse options "not to choose engineering" for their career path. Bettie also mentions that how easily women could consider dropping because they recognize the socialized and expected feminine roles – mothering, and caring for family members.

Seymour and Hewitt (1997) explain these career decisions and argue that gender differences in perceived “degrees of freedom” make women choose and change the directions: they lead more women than men to leave the sciences (Seymour and Hewitt, 1997: 278). Regarding the “degrees of freedom,” Margolis and Fisher (2002) address how women international students in the computer science, as the socially and economically disadvantaged groups, did not feel the same degree of freedom as did members of advantaged groups. Consequently they were more likely to stay in the computer science.

The engineering women encountered numerous assumptions and situations differentiating them from an engineering identity. Expectations generated by their family, friends, and other engineers were often inconsistent with success at engineering tasks. Further, if they wanted to stay in engineering, they receive the message that they must balance conventional feminine duties with engineering work. As a result, most of the women respondents reported that they not only thought about leaving engineering, they seriously considered it.

4.2.3 Feisty Women and Anxiety of Proving

Engineering women felt that they were perceived as “invaders” when they are treated “more carefully” or “nicer” by engineering men. Engineering women view this male niceness as an indication of their lower status or incompetence in engineering. And, sometimes, this recognition yields women’s strategic ways for surviving in engineering.

“I Hate to be Babied”

Women’s narratives frequently addressed how often they felt being treated differently or how often they felt different expectations from other engineering practitioners. Sometimes this differential treatment was cruel or mean. But sometimes it took the form of being “babied,” or held to lower standards. Such “niceness” sometimes made women engineering students feel they were different from “regular” or “normal” engineering students, and it made them feel weaker and less competent.

Emma: [. . .] guys perceive that as ‘You’re being helped more than I am’...so you know...it’s kind of coming from school and then when you get into higher levels of like the industry or research they still have the mindset of like ‘Oh, somebody is helping you’ [. . .] [Ph.D. student, Civil Engineering, Mexican]

Zena: I faced it in my internship. When I came there everyone was so nice. You have no idea, I’ve never, seriously, I’ve never experienced so much male attention. And (it is) not just because I’m young and all the guys are really old, but because I’m the only girl there and everybody wants to help you. But the problem is that nobody takes you seriously at the same time. They don’t expect you to do good. They don’t expect anything from you, in the sense that you’re supposed to be smart, they expect you to fail...they expect you to... ‘Aw, it’s ok. You’re a girl.’ So, it kind of puts you down, kind of makes you mad, in that sense. [Undergraduate junior, Petroleum engineering, Asian/Kazakhstan]

Zena’s experience during her internship describes clearly what it means to be a woman in engineering. Women are considered weak and needy, and these perceived characteristics make women seem “less” than others. Emma and Zena recognized that being treated nicer evoked (often) negative feminine stereotypes. They are women who “must-be-protected” in “men’s” arenas.

Eli: I don’t feel like an outsider or anything like that. Early on though, sometimes I was treated differently, not typically by my professors but sometimes by a teaching assistant or by my classmates. I would be the only girl in the lab group and the guys wouldn’t let me do anything. In one of the labs I

had freshman year, I was the only girl in my lab section and I found the TA hovering over me, which was a little disconcerting. I'm not sure he realized he was doing it, but I noticed it. It made me a little uncomfortable. [Ph.D. student, Civil engineering, White/Anglo American]

“At school, there is no distinction between a female or male engineer; everyone works together and notes nothing of my sex. However, in my internships, I felt very sheltered and underestimated as an engineer when working next to a male engineer. Supervisors would speak directly to the male engineers, I was babied and not allowed outside as long as the males, and was not even permitted on the drilling rig floor! Nevertheless, I worked twice as hard to show myself and by the end of the summers felt as equals. This issue is something I hope to change when I graduate as a female in the workplace.” [Autobiographical essay, Bunny, Undergraduate junior, Petroleum engineering, White/Anglo American]

Particular behaviors, such as “hovering over,” reconfirm the conventional idea of femininity. Bunny states that she worked hard to “feel as equal” to have the same opportunities of going outside and experiencing real engineering. Eli and Bunny demonstrate that kindness sometimes means forfeiting opportunities.

“Leniency” can be the advantage for some women in male-dominated areas, but not every woman perceives it as an advantage.

Julia: I think, exactly...(the advantage of) being a woman in engineering...they're much more lenient. [Undergraduate senior, Civil engineering, White/Anglo American]

Chu: How about the relationship with guys in engineering?

Teri: It's weird to have friends in engineering. It's strange, because most of the people I work with are guys, right...so you can be kind of friends with them, but you can't be real close friends with them, you know, you can't. I mean, it's not...it's just...like they...I get the feeling that they feel that they have to act better because I'm around, when I'm around, like in class, they can't tell dirty jokes or things like that which I think is only appropriate, personally, because I think it's unprofessional...and so it's like to do anything social, with just the guys...they don't want to do that because they want to go be “just the guys”, you know what I mean. And basically, I don't want to be around them when they're being just the guys either. So like socially, to have close friends in engineering, especially when you get into a field where there's like 20 guys to

every 1 girl, that's really hard, because they're just not there necessarily....
[Ph.D. student, Nuclear engineering, White/Anglo American]

Male leniency evokes women's status in engineering. Women are not considered as colleagues by men, because they are just women. So it is weird and odd for engineering women to have relationships with male engineering students without feeling the tension.

Men are not always "nicer" to women of course. Teri brought up her friend's case:

Teri: I have seen...there was another girl that I did undergraduate work with and she was real, you know, she had her opinions and she was going to tell you what they were and a lot of people didn't like her for that and it was really hard actually, you know, I felt kind of torn because not a lot of people would study with her, you know what I mean? And that kind of made me mad, I mean, because all the rest...there were some guys that were complete jerks and we would study with them, so what's the distinction here...umm...yeah, so that always bothered me. [Ph.D. student, Nuclear engineering, White/Anglo American]

Women are treated with leniency when they are consistent with the gender expectation of male engineering students. If a woman deviates from the normative ideas of femininity, such as having opinions or being aggressive, she is considered negatively by males. However, similar aggressive behaviors of men were interpreted positively. This reflects that "nicer" behavior by male engineering students is associated with women's status and power in engineering. It is a kind of chivalry. Men are nice to women because women are in lower status, who cannot be equal to men. Male engineering students do not think women can challenge them or beat them in "their game." Male

engineering students help women or become lenient because they do not think women are real competitors.

Emma analyzes about being babied by engineering practitioners:

Emma: I hate that (being babied)...I hate that...and it happened to me [. . .] I was working with some architects and they were like, 'your hair is so nice' and blah blah blah, and I was like, 'we're not here to talk about my hair, we're here to work and I don't like those type of comments.' And if you're clear, they know that you're there for real, you know, to work and not show off your pretty makeup or whatever and they will see you, kind of like another peer and they will not evaluate your nice dress or your nice makeup...but it's up to you. [. . .] It's annoying having people around you (and) just noticing your looks when you're not there for that, you know what I'm saying. It's not like I went to a party and I wanted people looking at me and (I) was like, 'shut up guys...we're going to work here,' you know, yes. But I agree...it's very, very uncomfortable...it makes you feel weird. [Ph.D. student, Civil engineering, Hispanic/Mexican]

In Emma's account, "real work" and "party" are clearly separated and she demonstrates that her feminine look within working places makes her feel that others are viewing her as a woman in social contexts, like parties.

Mandy: [. . .] I joined the society of women engineers, I'm finally...I'm with all the females that have been there, they understand what I'm talking about because they feel that. But as far as just the males...it's really, it's hard to explain...it's strange because I don't...sometimes...that first class showed me because they really didn't see me as their peer. They saw me as 'Woo-hoo, a girl!' That was wrong, that's not cool. [Undergraduate sophomore, Electrical engineering, White/Anglo American]

Mandy also had similar opinions about the difference between public, real work and private, playing. Mandy states that male engineering students see her outside of the engineering work arena. Men's ways of perceiving engineering women, "Woo-hoo, a

girl!” is “wrong,” according to Mandy because it misunderstands her goal of engineering work.

Emma and Mandy demonstrate that engineering work places should be separated from gender, but they also demonstrate the perception that gender or femininity is outside of engineering.

Bunny’s comments directly about beauty show that how femininity is viewed as incompatible with engineering by other engineering practitioners, professors and male engineering students.

Chu: Some engineering women argued that they were not taken seriously. What do you think about this statement?

Bunny: When he (professor) makes jokes with me, he’ll be like ‘Oh, well Bunny will just like fluff her hair or bat her eyes to get a job.’ like, it makes me mad. Like...umm...I take pride, I’ve interned, I mean, interviewed with every single oil company and I’ve gotten an offer from every single person I interviewed with and if I were to tell people, ‘oh yeah, I got an offer.’ They’ll be like, ‘it’s just because the guy thought you were hot.’ And I get that all the time and that makes me mad. [. . .] I was in charge of student recruiting this year and the teacher that asked me to do it he was like ‘You’re really sociable, you can talk to anyone.’ This is in an email, ‘and you’re easy to talk to,’ and in the second email he writes back, ‘oh yeah, and you have great grades.’ So, I was like ‘ok’...if it was someone else he would’ve been like, ‘You’re a great candidate, you have great grades, you’re really qualified,’ but for me, it’s just exterior. I definitely get that and so I often wonder...like, I told you about challenging and motivation, that’s definitely motivation for me. I love having it on paper, I mean, to me engineering is definitely something that enforces me being a woman and not just a girl...like, with a pretty face or something, you know. Yeah, I definitely encounter that. [Undergraduate junior, Petroleum engineering, White/Anglo American]

Her experiences regarding her attractive physical appearance reflects how heterosexual femininity is produced and reproduced in this particular context, the engineering school. Women’s heterosexual femininity is viewed as an inconsistency.

Why should this be “inconsistent?” Beauty emphasizes the woman as object – to be viewed for the pleasure of the viewer. Being active or a “doer” is the opposite of the object.

By being babied and treated in a condescending manner, femininity rises to the surface of the organizational context of the engineering school, and it becomes more visible, and consequently femininity in engineering is reconfirmed as abnormal or “otherness.”

Recognizing that femininity is “otherness” in the engineering school, some women students seek they ways to overcome this feeling of deflection. Talking about the image of successful female engineer, Bunny suggests being feisty:

Bunny: I had to be really dominant like that and umm... you would have to make yourself known and be heard and ask a lot of questions, in that sense be feisty...show that ‘yeah, we may be learning how this major drilling rig works and I may not care about tools or anything but I do care and I have questions too.’ That’s exactly how it was this summer too, and in that sense you have to be aggressive and show them that you could do stuff too, I guess, because you tend to be babied more....hahah...it’s true though. [. . .] He (my boss) didn’t want to let me balm the rig because he thought ‘she’s going to get hurt’ and it all depends, I’m not saying that’s everyone in the oil field, but I showed this guy, ‘no, I’m perfectly capable of this.’ I had to work to win him over. Just because...it is, it’s like all guys, heavy machinery and it is dangerous out there, so I think a lot of the old minds think ‘a girl shouldn’t be out here.’ Especially me, a college kid, I look just like a little kid compared to the hardworking guys out there. So, yeah, you have to be a little more aggressive and that’s exactly how I was. [Undergraduate junior, Petroleum engineering, White/Anglo American]

Bunny uses the terms, “dominant” “aggressive” and “feisty” for explaining strategic behavior. To “win over” male engineers, Bunny tries to adopt their words and be one of them.

Debra: Well, I can actually believe that (engineering women are competitive and self-defensive) because, you know, you already have this wall built up that you feel that you have to protect yourself because you're the minority, you're the woman, you're the minority...so, you're already going to build up, like you said, your defenses, you're going to be ready to go everything that the professor or men throw at you, you have to be ready for. And I completely understand that because I had to have that mentality too. I just couldn't sit back, relax, you know, like one of the guys, I had to be on top of my stuff too. [Undergraduate senior, Electrical engineering, Black/African American]

So, one of the ways that women choose to overcome their treatment based on stereotypes of women is by becoming more stereotypically masculine – being “on top” of their work like male engineers.

Anxiety of Proving

To be “noticed,” or “taken seriously,” women engineering students feel they must “prove” themselves. Striving for high GPAs, women believe, is one way to prove they are qualified to be engineers like men.

Teri: Yeah, I think I probably put extra effort into, definitely into proving myself, really, seriously, like that's what I felt from the very beginning. Once it was like, 'Oh, you're...you're getting A's in all these class,' then everyone's like, 'You're not a joke.' It's like every girl that starts engineering, I think, they think 'is a joke.' You know....like, 'They don't' really know what this is all about, blah blah blah...they're just trying to do something,' you know, it's a 'joke!' it be like that. You know, the girl kicker in college football, you know, that's a joke, most people see that as a joke. That's what it's like, you know, female engineer walking into class...we don't know if she can really kick that 40yard field goal. We'll let her try, but the odds are maybe not... [Ph.D. student, Nuclear engineering, White/Anglo American]

Gender schemas influence people's evaluation of others (Valian, 2000), and women are devalued in traditional masculine areas (Eagly, et al. 1992). Women in male-dominated fields is a “joke” because there is a conflict between the conception of

women and men's arena or work. They are not compatible at the same time in the same place. This conception leads to women's sense of being a partial outsider (being a woman in predominantly male areas), and it tends to intensify, and consequently women's gender identity becomes increasingly salient as a point of differentiation from their peers (Meyerson, 2003: 26).

Sometimes, engineering women strive for achievement by removing the salience of gender in the context. Bunny stated:

Bunny: [. . .] but I will agree that, yeah, you're definitely more noticed. I can see why she would do that. I did it, I never dressed nice to begin with, so...hahah...maybe that's why, but it makes you feel uncomfortable and stuff like that...yeah...that's why I'm saying, I think that's why I strive so hard to have good grades because people could so easily say, 'Oh you're a girl and guys do your homework for you,' you know, something like that. Where I feel like I'm...I feel better if I'm like, 'Ok, I have a great GPA.' [Undergraduate junior, Petroleum engineering, White/Anglo American]

Bunny was talking about other women who sometimes dress "cute." When she talked about the topic, and how women easily stick out in the engineering classroom, she ends up discussing her strong motivation to achieve good grades. To break the gender schemas, in order to prove she can do engineering as other male students, she strives to get great GPA.

The idea of proving herself by standing up to a "weed-out" system is important in establishing the "claim to adult masculine status" in the science and engineering disciplines (Seymour and Hewitt, 1997: 262). Her grades prove that she is able and qualified "in their eyes."

Women engineering students agree that they *have to* prove themselves by beating others with grades, but they do not like to do it. At the same time, they wonder if high grades really help them to be accepted by other students:.

Debra: Find difficult...in my first couple of years I did...my freshman/sophomore years I did...my junior/senior years I really didn't. When I first came in I think...umm...guys kind of looked at me differently. They probably didn't think we were as capable as them because I really got that vibe from other guys, but I think as you get more into your upper level classes they say, 'Oh, so you've been through everything. So you can actually do this.' You become, you start to become more credible in their eyes and so that's one bad part of engineering that I didn't like at all. As a woman I really didn't like that you were always having to prove yourself sometimes. Say you are in a group of all guys and you're the only girl and say you're the only person who can understand the concept, (but) you know, just thinking in the back of your mind, 'Oh that girl is dumb. We don't want to work with her, she's not adding enough to the group.' Just sometimes that mentality does come up and that's kind of hard. [Undergraduate senior, Electrical engineering, Black/African American]

Chu: What do you think about pros and cons of engineering?

Emma: [. . .] A lot of the male population just feels weird sometimes. Like, back in Mexico, people think girls join the engineer programs just to find a guy and get married, haha... I mean, really, which is like, no way. Maybe that's why I'm not planning to get married, maybe, I don't know, I don't know. Also, sometimes it's hard just to prove to others that you're equal, like, 'I can do this.' It's kind of hard sometimes. Sometimes they're like, 'Oh, here comes the underdog. She's trying to show us that she can do this but we know she cannot. Just be nice to her.' [Ph.D. student, Civil engineering, Hispanic/Mexican]

The idea that women must continue to prove themselves so that they “become more credible in their eyes” is commonly expressed. Debra's account shows that male engineering students have the authority to evaluate who are qualified to be real engineers. Emma's account also demonstrates that proving is a process to achieve “equal” status as men in engineering.

However, ‘proving’ by presentation of high GPAs is also not sufficient to obtain acceptance from the legitimated members of engineering, men. Debra says, even though the girl understands the course materials, she assumes other men engineering students do not accept her as a credible engineering student. Emma’s account also demonstrates that women’s efforts can be interpreted by men as a strategy of “underdogs.” Women already loose the game before they start it.

Women engineering students also realize that this proving strategy continues to women’s status in the organizational context:

Teri: [. . .] when you first enter these things it’s like people are questioning your ability from the very beginning. You can prove yourself, so to speak, but sometimes there’s this righteous indignation, ‘That’s not even fair because that guy didn’t have to prove himself from the very beginning!’ but after you prove yourself then you’re fine. [. . .] [Ph.D. student, Nuclear engineering, White/Anglo American]

Also some engineering women wonder or doubt the purpose of proving.

Mandy: [. . .] you know, we do have more to prove. I’ve worked so hard to prove ‘this’ to my peers. At the end of the day I wonder why, because I don’t need to prove anything to them, they don’t hire me in the future. So, you get to the point where, ‘Why am I proving myself?’ and somebody in my, you know, some of the other girls that I know in SWE we all get to that. We’re always proving ourselves because, you know...it’s not ...is it for them? Is it for a job? Is it for ourselves? If I’m not proving myself for myself, I start to wonder why am I doing it. And that’s...that could be a scary thought because do I want to enter a profession where I’m just working all the time to prove that I’m a girl and I can do this, ‘Yes, feminism rules’ or am I doing it because I like it and there’s going to be...just some improving of myself along the way anyway. I think so many girls realize that we’re just trying to prove ourselves for the wrong reasons. [Undergraduate sophomore, Electrical engineering, White/Anglo American]

To be considered as serious, real, and legitimated engineers, women try to prove themselves in several ways. This proving process is deeply related to the conventional notion of femininity and the status of femininity in engineering. Women sometimes actively adopt masculine behaviors and attitudes – aggressive, feisty, or to “dilute” their heterosexual femininity. Having a high GPA is the one way to prove women were qualified to do engineering like men. However, at the same time, women wonder why this constant proving process is necessary. Struggling to be legitimated, women also try to redefine the legitimated engineering identity.

4.2.4 Who Am I?: Understanding Femininity in Engineering

For women, defining engineering identity is often associated with defining femininity because femininity is frequently located in the “other” side of stereotypes associated with engineering. Something different from engineering identity often appears in terms of woman, womanhood or femininity. In engineering school, physical beauty and feminine appearance are considered as symbolic attributes of femininity or something making women different from engineering identity.

In the discussion of their womanhood and other women, engineering women demonstrated how their femininity was perceived and how defining femininity was complex and contradictory in engineering settings. For an instance, women addressed that femininity was interpreted by society in a certain way – feminine appearance or beauty was consistent with the image of women as a person who existed not only for herself, but also for the pleasure of others, particularly men. In other words, engineering women sometimes thought that their feminine performances – beauty, dressing, etc. –

made them complete as woman, but, at the same time, they also presented them as “woman” who existed for men. So, for example, dressing in particularly feminine ways, makes women’s gender role and their differences particularly prominent in the masculine culture. In their narratives, it was common for engineering women to distance their feminine attributes, particularly physical beauty from the engineering, in part to “de-emphasize” their femininity. Engineering women mentioned that feminine attributes were risky for constructing their image as engineers. This section delineates how women engineering students account for femininity by focusing on the way they talk about other women and their womanhood.

Weak Girls

When engineering women discussed their femininity and other women, they sometimes mentioned that some women were too “weak” to survive in engineering. They sometimes criticized other women in engineering for portraying “typical” female behavior and viewed this as evidence of “weakness.” Emma criticized her female professor because she “complied with everybody’s opinions” easily not showing her confidence and competence for doing engineering.

Emma: [. . .] she was very nice to me and she was a hard worker and I respect her a lot but sometimes I feel she’s kind of....complying with everybody else’s opinions [. . .] if they criticize your (her) job for some reason she would not stand up and say, ‘oh, no I think this other way.’ So, it’s kind of weird. You have intentional weakness in female professors.” [Ph.D. student, Chemical engineering, Hispanic/Mexico]

Emma seemed disappointed with her female professor and interpreted her professor’s attitude as “weakness.” From Emma’s perspective, compliance from a

woman invites others to view her as weak: she is too feminine. Of course, the irony here is that if men complied, they would most likely be viewed as cooperative rather than “weak.” Emma’s narratives reflect that how same behaviors are interpreted differently based on the statuses of the power relations in the engineering school.

Emotional behaviors, such as crying or concern with relationship issues, are also not compatible with the image of effective engineers and sometimes these behaviors are annoying to other engineering women.

Nikky: I’m sure they do (date each other). Actually, I know they do. You see...umm...you see couples walking around all the time, although, its really, really annoying for me to hear some female engineers sobbing over how her boyfriend broke up with her...ugh...It’s like, c’mon!, because you can’t let stuff like that effect your work. You can’t afford to be depressed for several days on and because your work is just going to pile up and you’re going to be crushed by the stress afterwards, which won’t be any better from the stress because your boyfriend broke up with you. But I’m sure, you know, that’s just a worse case scenario. [. . .] [Undergraduate junior, Aerospace engineering, Hispanic]

For Nikky, sobbing over a broken heart is not allowed for normal engineering students, because engineering students would “not let (emotional) stuff affect their work.” Emotional issues and being too emotional are not “affordable” for engineering students. In her perspective, such emotional behaviors make engineering women look weak or deviants, who spend too much time for their relationship issues.

Nikky: I watched so many girls fold under the weight of the amount of work, and I’m not exaggerating. Like, I would just be walking with a group of them, if we had a meal together, like a hall meal, a lot of them would be talking about how much work they had to do. On the rare occasion one of them would be crying because they couldn’t handle the workload, and I’m not surprised at all by that (many girls drop out of the engineering school) because I haven’t really seen very many guys crumble like that, under the workload, but I have seen a lot of girls happen. So that statement does not surprise me now. I do not know why girls crumble, under the workload, but that’s the reason. It’s just gets to be

too much...I guess, they're used to a certain lifestyle. They're used to a certain amount of free time, a certain amount of socio-organization time, and they're not getting it, or they wish...they just wish to have more time to do other things or they just don't want all the stress that having, you know, a lot of tests and long homework assignments, they just don't like that stress level. Some of them don't handle stress very well, when it does come. You know, they'll do fine, say it's not a test week...yeah, but that's the cause...is girls fold under the weight of the classes much more than guys do. I have seen guys fold though, just not as many. [Undergraduate junior, Aerospace engineering, Hispanic]

Nikky emphasized women engineering students were more likely to “fold” under the heavy workload than engineering guys. She interprets women’s high drop-out rate in engineering school to their inability to complete the workload. Male engineering students rarely “crumble” like women. In her perspective, engineering women were not used to the heavy workload and the engineering learning practices, and they could not handle the stress effectively. This criticism about girls who cannot successfully adjust themselves to the engineering practices is transmitted to others.

Chu: My survey shows that women are more likely to leave engineering programs than men. What do you think of this result?

Mandy: [. . .] we just like more creative things...we like...if anything is pretty we just do. It's not like it's just offered to us, we have time to do that, we're underappreciated, made fun of...just all the differences you see in the way you're treated by your peers, especially the male. And even with the girls that are more into it, the more masculine, I don't...here's what I mean when I say that...the ones that are 'more' like engineers, like more like the guys, but you know, even then they kind of look down on you...hahah. I don't know, it's a real threatening environment sometimes. It's not that the advisors aren't nice or that we don't have people to talk to, but...I can't...I don't know...I can't explain it, but it's just not...it's not an environment that's necessarily very supportive of females. I don't think those are always addressed. I think it's still male, very much male oriented. [. . .] [Undergraduate sophomore, Electrical engineering, White/Anglo American]

Mandy felt she was criticized by not only guys but also other girls. Engineering girls, who were “more like guys” or “more like engineers,” distanced other girls, who might evoke undesirable characteristics of engineers, femininity. A self identified “girly girl,” Mandy stated that the cultural “environment” was threatening because her girly-ness was not welcomed in that context. By suppressing or distancing certain characteristics, femininity, the dominant definition of engineers or engineering-ness is constructed. In this constructing process, the legitimated engineering identity is developed in relation to a subordinated characteristic of engineers, girly-ness or femininity.

Two Distinct Kinds of Girls: Pretty in Engineering

One of the participants said that she felt disregarded by other engineering students for her girly-ness. The girly-ness was rejected and excluded by engineering students, including female engineering students, because there was a perceived contradiction between it and the engineering identity. Girly-ness was described in relation to the dominant idea of engineers. In this section, women engineering students discuss two distinct types of engineering girls, and how being beautiful or symbols of femininity conflicts with being an engineer.

Women engineering students talked about types of girls in the engineering school and suggested the guidelines for categorizing the types based on their appearance and attitudes. The topic of two distinct types of girls appeared while the focus group participants were talking about dating in engineering.

Mina: They (engineering men) date out of engineering. [Graduate master student, White/Anglo American, Group2]

Della: They date the education girls. [Undergraduate senior, Black/African American, Group2]

Chu: Why?

Mina: I do not know. [Graduate master student, White/Anglo American, Group2]

Della: Oh, because, my ex-boyfriend said that there are just no cute girls in engineering. I said, excuse me, hello! But then he just later on said that engineering girls just are not attractive because, I guess, there are two distinct kinds. There is not a lot of the kind that I have seen that dress up now that was I guess during the younger years. Just the regular cool girls that go around in jeans and t-shirts, and that is it, they go to class and that is it. [Undergraduate senior, Black/African American, Group2]

First, there are two kinds of girls, education girls and engineering girls. Mina said engineering guys did not date engineering girls, and then Della clarified that engineering guys dated the other type of girl, education girls. This shows there is a perception of engineering versus non-engineering, and this recognition connotes the boundary between two different kinds of femininity, or femininity versus non-femininity.

Della characterized women in engineering based on that boundary – “not a lot of the kind that she has seen (dressing up girls)” and “regular cool girls (in only jeans and t-shirts).” Dressing up women in engineering are few, as Della stated, so other type of girls who are in jeans and t-shirts, then are regular.

May: [. . .] The only problem with dating an engineer, I guess if you’re a normal engineer you’re normally a guy...there’s like four girls in this class, but there’s not a whole lot of them. I’ve noticed that engineers either like very intelligent girls who have very specific goals or they like the air head ditzies that don’t have any clue...you know, there is no in between. So it just depends, I guess on the person...it’s not really a stereotype or anything. [Undergraduate junior, Electrical engineering, White/Anglo American]

May also has clear guidelines for categorizing women in engineering. She actually categorizes women as distinct from “normal engineer,” guys. “Engineers” like

two different types of girls – “the intelligent having goals” like guys and “air head ditzzy.” May defines and describes these two types of girls very strictly because there is “no in between.”

While Diana was talking about dressing in engineering, she stated that she felt bad about the girl who bought baggy jeans and flannel shirt for her intern job. Then she questioned what it meant to be feminine or show femininity in engineering.

Diana: [. . .] I mean, there are girls who are just more tomboyish, more athletic and they don't like to dress up at all. There are girls like that everywhere, not just in engineering and there are also girls in engineering who are more girly and like to have the latest fashions, just like everybody else. You know, you just have to say ‘who am I?’ Do I identify more with this girl or this girl? If I identify more with these girly friends maybe I want to be friends with them, but there are girls like that in engineering, I see them all the time. I have two (types) of the girls in my senior design group, you know, last week I had to get on to them because they were sitting, they were like ‘Where did you get your nails done? I like that.’ ‘Oh, there was a coupon for that.’ ‘Oh that’s so cute.’ I just say, ‘Ok, c’mon guys get back to work.’ hahah...I mean, there are girls like that too. They are there. [Undergraduate senior, Civil engineering, Asian American]

Diana also talked about two types of girls and she said she thought of which category might apply to her. She sees girly girls who are everywhere, and while they are normal, they are not that common in engineering. The way she describes girly girls demonstrates that these girls are not interested in engineering and not serious engineers.

Identifying self as an engineering woman is a complex process. As discussed by Howard and Hollander (2000) and Connell (1995), self identification processes are political processes aimed in part, to achieve the legitimacy from other group members. As seen in the discussion of the focus group members, certain types of engineering girls were devalued and viewed as illegitimate.

In the focus group discussion, the participants talked about dressing, what some engineering girls thought about what clothes to wear, and how this might relate to the question of types of women who enter engineering. The following excerpt shows how certain type of women are evaluated and stereotyped particularly by both men and women.

Denie: I have been a tomboy so. I have got stitches in my arm from climbing fences and playing tackle with my brother. I have never been a girl's girl. That kind of thing I put on makeup for fun I am kidding around and we are all going out let me try and put on this eyeliner and poke myself in the eye. That aspect I guess it doesn't bother me because I am not into skirts I am more comfortable in jeans and a t-shirt and some sandals. I have hang nails all over the place that has never been a bother for me so I really can't relate to that statement. I have sleep deprivation. [Ph.D. student, Black/African American, Group2]

Mina: But everyone does that it is universal. [Graduate master student, White/Anglo American, Group2]

Denie: It is a state. [Ph.D. student, Black/African American, Group2]

Mina: It is interesting in mechanical there is definitely two kinds of girls in mechanical engineering. There are the girls, that are you and me, that is just how it is you like to wear jeans and t-shirts. Then there are the girls who do try and dress up more often. They carry the purse, they wear make up, and they get ready in the morning. It is funny because you hear the guys and they automatically based on who they are tagging out which category of girls they think. (Guys say like,) 'Oh yea, I want her on my team she is really good, she is really smart, she is going to help me a lot and we will get a good grade.' Not like she will do the work but we will do good. Then there is she has been cheating to get as far as she got there is no way that she could have made it on her own this far. Some of my good friends were in that other group and sometimes I even found myself thinking that same thing. Sometimes it is true sometimes you do get by not on your own. But I have done it probably no more than they have. So, it is interesting but the guys definitely have a set stereotype of this girl is a good student and this one just slipped by some how." [Graduate master student, White/Anglo American, Group2]

Denie identified herself as a "tomboy," not a "girl's girl" and, as a busy engineering student who has "sleep deprivation," she cannot understand why some women engineering students are concerned about how they look and how they dress.

Mina develops the topic of “tomboy” versus “girl’s girl” with exemplifying two different types of girls in Mechanical engineering.

The boundaries between two types of girls seem apparent in Mina’s account and also the perception that male engineering students react to these types differently. Certain women, who dress up and carry purses, are considered as the ones who “just slipped by.” This evaluation based on the categories comes from the idea of what engineering is and what engineers should be.

In the interview, Bunny shows how the conventional concept of femininity does not go hand in hand with the concept of a Petroleum engineer:

Bunny: Like in high school, of our senior class, like I was voted most beautiful. Now I talk to people from high school and they’re like ‘what are you majoring in?’ I’m like, ‘petroleum engineering,’ (and) it just doesn’t go hand in hand. [Chu: Why not?] Well, like in my essay when I was writing, I was just trying to relate like how far I feel like I’ve come in things...what being an engineer means to me. Like, in high school I was ‘little miss social.’ I was voted most beautiful. Like, people probably looked at me more for looks than like my brain. Now looks...nobody even cares, I don’t even brush my hair to come to class half the time, but it’s just, do you know what I mean, I feel like people look at me for how I can help them out with my knowledge rather than like look at me as how I look or as a girl, you know, and that means a lot to me. I feel like...ummm...if I’m around...I don’t know, sometimes people overlook me, so to speak. If they were to ask a question or have a problem they wouldn’t ask me. But if they know that I’m an engineer and a successful engineer they’re going to be, like anyone, they would ask them. Like if I’m sitting in a room and you had a math question, are you going to come up to me and ask me a question on a derivative? No, you’re not but yeah, you can...so that’s kind of what I’m trying to get at. [Undergraduate junior, Petroleum engineering, White/Anglo American]

Being pretty or displaying conventionally considered feminine characteristics, such as being social, do not go well with engineering. Math skills, which are the symbol of science-based fields, are placed as counter to beauty in Bunny’s account. Bunny

explains how the obvious symbols of femininity such as beauty disturb the development of engineering identity.

As also shown in Bunny's autobiographical essay, people do not match feminine beauty to intelligence, especially engineering.

"In addition, my image of how I feel others see me has tremendously changed. In brutal honesty, I was voted most beautiful of my senior class, was heavily involved in theatre and athletics, and was never notorious for being anything near intellectual. Now, when people ask what major I am in and I reply with "Petroleum Engineering", I feel as though people don't view me as a mere blonde anymore. Even more assuring, I interviewed with over ten of the top companies for internship positions and received an offer from every single one, showing me that I could physically bring something of value to the industry some day. While all of this could go to one's head, my past achievements humble me as a person and bring a joy to me that I have never known. Also, I feel as though my credibility with others increased. My friends call me for help with math homework, my dad trusts me on various projects, and I trust myself with managing the bills!"

-Autobiographical essay, Bunny, Undergraduate junior, Petroleum engineering, White/Anglo American

In her essay and interview, it is obvious how Bunny tried to overcome the stereotypes of a "beautiful girl" in engineering. When she is being "brutally honest," she is beautiful, and she thinks being beautiful does not help in being an engineer.

Being pretty and blonde disturbs her engineering identity, so she "humbles" herself and tries to "increase her credibility" with others. From her essay, we can assume that she struggled to achieve the serious, intelligent, regular engineer status.

Other women engineering students also discuss what it means to be pretty or what it means to be feminine in engineering.

May: There is one girl, she sits right in front of me and does, she dresses...she's got the, you can tell she straightens her hair every morning, she puts on makeup, worries a lot about her appearance and everything, and she wears Abercrombie

and Fitch, you know, short shorts and tank tops, blah, blah, blah...which is unusual. In fact, the majority of girls, don't worry about their hair, they don't wear makeup and they still stick out, so you can try as much you want to not stick out and you're still going to. Yeah, there's this one girl and she sticks out like a sore thumb. She's blonde, gorgeous hair, she's gorgeous, so, she really sticks out. [Chu: What do others think about her?] That's an interesting thing actually, because I sit right behind her and I've got these guys that are always talking, 'Yeah, I bet she's a ditz and blah, blah, blah,' and she opens her mouth and she's talking to some guys that sit next to her and she's like, 'Yeah, I made a 98 on the exam,' and the average was like a 52...and these guys like sit in stunned silence, because you know, this girl...she's pretty and she's smart, and more often than not, for whatever reason, that doesn't mix very well...but, it happens, it happens...but...I don't know. [Undergraduate junior, Electrical engineering, White/Anglo American]

Mandy: Cute and engineering apparently don't go together. I mean, I'm not trying to sound like I have a big ego but, I'm a cute person. I think I am a cute girl and that's what 'weirds' them out the most. They just don't know what to make of me. I wonder what their type is and (what) they think. All we can talk about is technical stuff. [. . .] One of my really good friends is an engineer and his girlfriend is in elementary education. I see it all the time. It's not because I think he's sexy or something like that, (it's because) they don't think that girls in engineering is attractive, which is kind of strange. It frightens the liberal arts guys because you're in engineering they think, 'You're so much smarter than me,' all those kind of stuff...or you know, they feel even threatened. So you're sort of left as the odd man out, hahah, 'Who's going to date me? Nobody,' you know....hahah...I don't know what I need to do. I don't know...that's definitely hard in college...my boyfriend, he and I recently broke up, but he was an English, creative writing major. He told me, multiple times, we got on the subject of careers, money and all that stuff and he was, it turned out. He did say that he felt less masculine because I was doing what I was doing and he was doing what he was doing." [Undergraduate sophomore, Electrical engineering, White/Anglo American]

As May and Mandy say, "being pretty or cute" and "being smart or doing engineering" do not "mix" or "go together" well. Attractive feminine appearance emphasizes the gender identity of women engineering students, and it builds boundaries between men, engineers, and us – women, non-engineers, others.

Furthermore, in the process of drawing the lines between engineers and non-engineers, men who do not do engineering are sometimes assumed to be “less masculine.” Mandy’s former boyfriend, who was majoring in English, felt less masculine because his girl friend did engineering, which was an intelligent “men’s job.” This suggests that the socio-cultural foundation for the distinction of the “hegemonic masculinities” is from the subordinated masculinities (Cornell, 2002; Kimmel, 2000; Lorber, 1995) in the society. For men, the classic “other” is, of course, women. However, as represented in the quotes, there are different types of “others” within men or masculinities of this current society. The hegemonic masculinity of men who are in the dominant position is constructed in relation to the subordinated masculinities as well as in relation to women (Kimmel, 2000; Connell, 1995). The man who majors in English does not meet the “normative standard” of hegemonic masculinity, and is considered as “other.”

Being a Minority Woman Engineer

So far, women engineering students, regardless of their race or ethnic category, commonly claimed what it meant to be women in engineering. However, there was a difference in experiencing engineering in terms of race. The survey results showed White women considered leaving more than minority women or men. Minority women did not differ from men in whether they considered leaving.

To explore how race affects the construction of identity in engineering school, I asked minority women engineering students a few questions about how race/ethnicity affected their engineering experience. 13 out of 22 interview informants were women of

color. When told of this race/ethnic distinction in women thinking about leaving engineering, all of them agreed that ethnic and racial differences had influenced their attitude, and the strength of their “motivation,” in school.

Jill: Well I think, once they get into the program they're already motivated, they want to do this regardless to what someone else (say)...they're already motivated...so...but they're already at a disadvantage anyways because they're coming in as a minority, so they know what they're getting into once they get started. [Graduate master student, Mechanical engineering, Black/African American]

Jill states minorities are “already” motivated because they know they are the disadvantaged group in society. Another minority woman student explained this disadvantage in terms of the racial stereotypes.

Chu: Gender is significant only in the White group, what do you think about this result?

Maali: I don't know...I guess, that could be the only thing, I guess...the fact that...if you're black you realize that people might be looking at you because they see that you're black and that you might not be smart enough to do it and that might make you more determined to stay in it, and know you have to prove to people that you can do it, versus, I guess, if you were white. That could be, that would be, I guess, the only explanation I can think of...just to kind of stick it out and show people you can do it. [Ph.D. student, Chemical engineering, Black/African American]

In Maali's account, it is the “fact” that “Blacks” are looked upon as “not smart enough” to do engineering. To do engineering, to reduce the distance between being Black and engineering, Black students “have to prove” their ability to others. Messina detailed this fact with some examples. Experiencing college life, race seems powerfully influential in Messina's account. She emphasizes how she has many encounters in which racial and ethnic identity is salient.

Messina: In my group there are two Caucasian, you know, students who I'm in a group with. To me they kind of shut me out. I don't know what the reason is. I don't know if it's because of, you know, my racial...my ethnicity or that type. They just seem not inclusive...I don't know, if it's because, I think both of them...they probably went to freshman, sophomore and this is their junior year together and they're more comfortable with each other, like I said they (inaudible). I don't know what it is, but sometimes I feel uncomfortable. But I don't know the reason why they're not so inclusive or they seem indifferent to my presence sometimes, but I don't know what the reason is, but in that instance I felt uncomfortable. [Chu: Could give me some examples?] Ok, for a project, there were like five different parts to it. They would start on it and we'll be doing this, 'You can do this or this is what he's done up to this point,' as if my input wasn't necessary, you know, doesn't matter and I would make suggestions and it's just...not acknowledged, things like that. [. . .] Well, instead of getting upset I went to the professor and said...because it is my project and I'm part of the group and the grades are going to be part of my grade...so I went to the professor and I said, because I, based on the information we learned in class, I knew that this is not right. So, I went to the professor to confirm that. This is not right, this is what I thought, he confirmed what I thought and then I went back to the group and said I went to the professor he said that this is the way we're supposed to do this and after I what we did it, what I confirmed with the professor came up correct. So, it's like I need to go to the professor to validate that my opinion should be included because without his validation it doesn't really matter what comes from me. [Undergraduate junior, Civil engineering, Black/Caribbean]

Messina is looking for the reason why “they (Caucasian engineering students)” shut her down and why she felt “uncomfortable” with them. She wonders if it comes from other aspects, but by clarifying the race of other engineering students at the beginning of her talk, she emphasizes how she perceives race as important for dealing with other engineering students.

Minority women clearly recognize how their racial identity is perceived by others. Responding to the survey results, Debra explained how minorities are viewed in higher educational institutions, particularly in engineering school, and she thought about how her racial identity was influential in her decisions to stay in engineering.

Debra: Well, that's...yeah, that is very interesting. I think that minorities may be more apt to stay in engineering programs because, like you said, it is more challenging and they do want to get through and they do want to prove themselves. And they don't want to get out because how would that make them look, you see what I'm saying...versus, I guess...a white person, if they change majors, they're just changing majors, but maybe if a minority student changes majors they'll be like, 'Oh, that black girl couldn't cut it here so she's going somewhere else', and so some people may think that way. As far as I'm concerned the slight thought of me changing majors, that did not come from, you know, gender. That just straight out came from, you know, 'is this for me,' 'is this really for me?' And I never, of course, changed my major out of engineering. But I know some minority students are, you know, saying, 'I'm here for a reason and I want to finish what I started,' and they may not totally 100% enjoy engineering, but they know they want to succeed because they know if they...it's a challenging major and it says a lot about them, if they do finish. [Undergraduate senior, Electrical engineering, Black/African American]

In their meta analysis of the multi-layered associations of race, gender and science, Clewell and Ginorio (2002) conclude that studies in academic performance and confidence of science and mathematics are show less gender differences in minority groups, particularly in the African American group. Debra states how the same behavior – leaving or switching engineering majors can be perceived differently based on race. Engineering is more “challenging” for Debra because she thinks minority groups have the burden of proof for being a member of engineering group.

To the statement of “race is more powerful for making women stay in engineering,” Maali, expressed an “indescribable” feeling. And she talked about being a Black in engineering.

Maali: Yeah, I think that's true. They do see you're being black first versus being female first, you know, because it's much clearer. I don't know... I guess it just plays a bigger role than being female...I can't describe it.

Chu: You can't describe it, but you feel the same?

Yeah, I feel that way...I don't know...I guess you just get used to it...growing up all your life, you kind of get used to it and you kind of, I guess, ignore it, or

not really see it (is) there, and so...you...I guess you just kind of look past it all the time. You kind of train yourself to do that, so you don't see it as much anymore even though it's still there, and someone else who's looking on the outside can see it immediately and you've kind of adjusted yourself to not see it anymore...and so... [Ph.D. student, Chemical engineering, Black/African American]

In Maali's account, being a black seems separate from being a female, because she thinks people perceive her a black "versus" a woman. She mentions race is much "clearer," but she cannot explain why "race plays a bigger role." Later on, in the interview, she explains the irony of being minority in this society. As a social institution and individual attribute, race powerfully organizes individuals' lives but individuals are coerced not to admit it. Her account implies how the racially hierarchical society encourages ("trains") people to accept the "color-blind" ideology (Bonilla-Silva, 2003).

Messina: Being a girl, but I think...I think if there is a male engineering student they might see a white female student and they think 'Oh, she's a girl,' and they might see me, 'Oh, she's black.' I think that's what they see first, to me. Oh, she's black and she's a girl...that's what I think. Specially, since the atmosphere...that's how it is here in terms of, you know, resistance to diversity and that kind of thing. (People think) she got here from affirmative action and they had to drop the standard, you know, things like that...so that's why...I think I would be seen like that first then female. [Undergraduate junior, Civil engineering, Black/Caribbean]

In a (white) male engineering student's perspective, a white woman engineering student does not have a racial identity, while he sees only the race from a black woman engineering student. Messina talks about how black racial identity becomes salient in the white dominant society ("atmosphere"), and black racial identity is perceived by the Whites – unintelligent, cannot do engineering, the beneficiary of the Affirmative Action.

Many minority informants stated they participated in student organizations for minority groups and they thought the participation in those organizations was important. Below is what Debra said regarding engineering organizations for minorities, and in her narrative, she implied the different significance of general women's organizations and black students' organizations in engineering.

Debra: I once was in SWE, society of women engineers...umm...but for some reason, not that I didn't see the purpose of SWE, but I kind...my membership fell off because I was trying to see what they could provide for me as a woman engineering. And I guess, I got more comfort out of...because I was in SWE and I was also in National Society of Black Engineers...and I think I got more out of NSBE. So that's why I stuck with NSBE vs. SWE, and so...I just think that NSBE was more helpful to me and SWE was just, you know, have speakers come, things like that, but the meetings that I did show up to I really didn't see them emphasizing anything about being a woman engineer, how to conduct yourself as a woman engineer, how to help you...that's why I kind of deviated away from SWE. [Undergraduate senior, Electrical engineering, Black/African American]

Debra puts SWE on the other side of NSBE, saying “why I stuck with NSBE versus SWE.” According to her, SWE, even though is considered as well-known and one of the most well organized engineering women's association was limited. She stated that this organization did not show her how to conduct herself as a woman engineer. Meanwhile she found more “comfort” in black students organization and got “more” out of the black organization. A similar opinion appeared in Messina's account:

Messina: [. . .] So, I think it helps. I mean, besides social activities, you have volunteer, you have...umm...different speakers come in, you know, from the engineering field and so forth. Like any other engineering professional societies. I think they focus a lot on the issues affecting, you know, us, and, you know, it's support specifically, for minority students [. . .] I just feel more comfortable in NSBE, and I participate more with them because I think...I know that every Caucasian person is not the same and not (inaudible) and so on, but I think I would make the same sort of exclusion in the American society of civil

engineers just because most of it is white, you know, they come up with their own ideas and so forth...at least I don't have that barrier to deal with whenever I'm in with NSBE. [Undergraduate junior, Civil engineering, Black/Caribbean]

Messina clearly expressed that she did not have to “deal with” white engineering students in the black organization. This echoes how someone’s racial identity is constructed in relation to other racial groups and social structure of race. Tatum (1997) argues that adolescents of color are more likely to be actively engaged in exploration of their racial or ethnic identity than are White adolescents because they receive more intensive “racial content” messages from their surroundings and they perceive how their racial identity is presented to other racial group members (Tatum, 1997: 54). Messina and Debra show the interactional process of racial identity construction in the white dominant society.

On the other hand, some minority women students expressed different opinions about race in engineering.

Bela: I don't think...I've never felt like I'm, you know, I've never felt racially inferior. I mean, it may have come up, a racial issue may have come up once or twice, but that's going to be across the board, that's going to be anywhere, and I don't think that has anything to do with engineering, but umm...I know, for me, I'm Nigerian American. So my heritage is Nigerian so if you ever...Nigerians are usually doctors or engineers, that's it. [. . .] I think...well, for a minority to come into engineering, if that's what you're asking, I think for a minority to come into engineering, they know what they want. They're not coming in here to just play around and get the college experience. I think, like I said, for a minority to even come to college, it's a step. For a minority to come to college and do engineering, is an even bigger step. So they didn't come here to mess around. [Undergraduate junior, Petroleum engineering, Black/Nigerian]

Bela explains how Nigerian American is different from other minority groups in terms of class – “Nigerians are usually doctors or engineers.” So, she claims racial

inferiority is associated with the social class status. She confirms her idea about this relation of race and class by explaining “their” goal of minority groups. Other minority groups, “they” do not come to college for playing around or just for having college experiences. “They” come to college for having a “bigger step” or climbing socio-economical ladder of the society in most efficient and fastest ways.

Some other minority women did not see the salience of race in engineering.

Emma said she had not have encounters making her racial identity salient.

Chu: Another woman said her race was more salient than gender, what do you think about this statement?

Emma: I don't think that happens in my case. I'm able, kind of like to, you know, I'm able kind of like to mingle and people will think first, 'Oh, she's female' rather than, oh, she's Hispanic.' Maybe if I don't talk, they will not listen to my accent and they would be totally cool but, uh...I think gender comes first. I don't know about African American. I'm not familiar with their case but when you talk to somebody, for example, if your advisor is an African American or a black person, I think you can get past that thing and don't look at, 'Oh, he's black, he's male.' You're really talking to the person and to the guy, the person who has the knowledge and not 'oh, I'm talking to this black guy' or 'oh, I'm talking to this male.' I think...maybe it's just the first impression, but after they know you all those things fade away. [Ph.D. student, Civil engineering, Hispanic/Mexican]

Emma states that she is “able to mingle” with other people, so for her, race is not the obvious barrier to overcome as African Americans.

Nikky sees race as a cultural difference differentiating groups:

Nikky: I'm not exactly sure...I think at this school it's still...the vast majority of it is white, (so) in this particular instance, I don't think it has that much of an effect. No, I don't think race and ethnicity plays a role because a vast majority of it is white, unless the majority of your statistics you're collecting would be of that nature. But, if for instance, say this was another school with a minority and a majority, then, I would say it depends on two factors, the family and the culture of the person. I'm pretty sure this is a stereotype but I've seen it to be true in my high school that Asian families value education a lot more than say, Hispanic families. I don't know, but Asian families tend to value education a lot

more...and I know because a lot of the top people in my graduating class were Asian. [. . .] [Undergraduate junior, Aerospace engineering, Hispanic]

Nikky does not seem to see how racially disadvantaged groups are perceived by others in the racially hierarchical society. In her account, race and ethnic groups are just “culture.”

So far, through their narratives minority women students claimed race was more salient for constructing the engineering identity. When they encounter the situation challenging them to keep the engineering identity (consideration of leaving the engineering programs), minority women said their race motivated them to keep the engineering identity. Their motivation seemed to come from their racial situated-ness in engineering: to being a minority conflicted with to being an engineer.

On the one hand, this means that in the racially hierarchical society, in the white dominant society, certain races become more obvious than gender. Some minority women’s accounts (particularly Messina and Debra) about comparisons between White girls and Black girls coincide with this argument. White women’s racial identity is not recognized in the engineering school, however, black women’s racial identity is always obvious to others.

Secondly, as Burke and Stryker (2000) demonstrate, individual’s identities are constituted with hierarchically ordered identities set, and in certain contexts particular identities become more salient. For the minority women engineering students, race becomes more salient than gender in their identity set in the organizational context of engineering.

On the other hand, this demonstrates how femininity is considered in engineering. It seems minority women engineering students understand race and gender separately in their identity set. When they were talking about thoughts of leaving, they rarely talked about how minority *women* were evaluated by others in engineering. Some of them emphasized they were doubly bound as a woman and minority, but their recognition did not detail how this double bind had a synergy making them more motivated. In other words, they more focused on how race was evaluated by others, not their gender, femininity, or sexuality. Black femininity has been constructed and understood differently from Whites through American history and culture (Hill-Collins, [1989], 1998; Brown, 1996; Berry, 1999). Femininity and race often seem to separately exist in women's narratives about experience in the engineering school. This also seemed echoed in minority women's discussion about dating in engineering. While they talked about dating in engineering, no one brought up the issue of what it meant to be a woman of color or how the femininity (sexuality) of color was considered in engineering interacting with other male engineering students. In discussing being a minority woman engineer, femininity is neglected. To "prove" they are legitimated members of engineering, femininity is neglected again in the minority group, because femininity is not the component of engineering identity.

4.2.5 The Moment of Engaging in Femininity: Dating and Dressing

Dressing and dating address how engineering women students engage and define heterosexual femininity. In a male-dominated arena, women engineering students confront "traditional" situations that often contrast with their nontraditional career path.

Experiences of dating and dressing, as a part of everyday practices, demonstrate the conflict or feeling of deflection engineering women may encounter.

Dating

Engineering women's narratives about dating demonstrate how they think men think of them as woman. So, talking about dating is associated with engineering women's and others' perception of heterosexual femininity. Women engineering students see themselves struggling on the borderline of being an engineer and being an attractive heterosexual woman.

First of all, dating and talking about dating demonstrate the cultural stereotypes of women in higher education. Teri said:

Teri: Oh, gosh, that's terrible, you don't...it's awful to do dating in engineering, nuclear engineering too, because we're so small, like gossip spreads widely. It's crazy. Umm...when I was...ok, I decided to go to grad school and I went to another school, I went to Michigan, and there was a professor there and he was talking to me, telling me that one of his female students, I couldn't believe this, he was like, 'Yeah, she met her husband here. This guy kept bugging her to go out with him.' Making sure my statement is correct, 'Bugging her, she finally said yes and they ended up marrying.' then he looks at me and says, 'That would probably happen to you if you come here,' and I'm like, 'What!!!!,' you know, 'C'mon, that's ridiculous for you to say!' [Ph.D. student, Nuclear engineering, White/Anglo American

Teri was shocked by her professor because she felt he assumed that she came to the graduate school to find a husband. Cultural belief about gender appears in women's accounts about dating in various ways.

Bettie: Actually, I have a boyfriend, but he's not an engineer...hahah. Some of my guy friends that are engineers, they don't date engineering girls [. . .] Gotta be good looking and fun and all that sort of stuff. Actually, my personal view is that I think they just don't want a girl who's as smart as them because a lot of guys, you know, they like to be on the power trip, 'Oh, I'm smarter than my

girlfriend,' that type of thing. I think it's a little intimidating, you know, if a girl is doing better in your engineering class than you are, I think that might be (inaudible). Yeah, I don't really know that many engineering guys that are willing to date an engineering girl. [Undergraduate junior, Petroleum engineering, White/Anglo American]

Bettie seemed to have a strange feeling about her dating experiences because she laughed when she said her boyfriend was "not an engineer." According to Bettie, engineering guys do not want to date engineering girls since they want to be in the "power" position. Bettie connects "power" with "smartness" and, in her account, "on the power trip" means "doing better in the engineering class," – smartness. Traditionally, men are supposed to be in control and more powerful than women, but Bettie is dating a guy who is not in control and powerful, according to the suggested standard in engineering, so her dating experience means a subverted relationship between two genders. This leads her to laughing in her account.

Mandy has similar opinions about dating pattern in engineering:

Mandy: [. . .] but I still think for the most part guys don't like the girls that are as smart as they are. [. . .] They don't want to date engineering girls. [. . .] they don't feel like necessarily the girl has to be as smart or something like that, and they haven't, I don't know...I think that's a wrong assumption...some of them do, but there are some that definitely don't, I've seen a lot. That's just what I've noticed. They were really interested in dating me till I opened my mouth and I could utter a coherent sentence. [. . .] Because I was actually intelligent and I was making higher grades than them, they felt really threatened, and they backed off... [Undergraduate sophomore, Electrical engineering, White/Anglo American]

Women's physical appearance attracts men, but as Mandy shows, intelligence disturbs and "threatens" men.

Kelly: Some guys, I think some guys are intimidated by smart women. Like, I

mean, some guys are...not all guys, just some. And so I think sometimes the guy likes to date a girl that he feels he's a lot smarter than because he wants to be like the powerful one, the one in control. Not all guys are like that...my fiancé is not like that, but some are. Whereas girls feel more like what I was saying, 'I need to be on the same intellectual level with this person, doesn't matter what really their major is,' but if I'm a smart girl probably not going to get along with a dumb guy...hahah. It's true...hhaha. So I think...whereas guys...I don't think they care as much because a lot of them. I mean, they like to be the strong one, they like to be the smart one, the successful one and stuff like that...and that's just fine. [Undergraduate senior, Mechanical engineering, White/Anglo American]

“Strong,” “smart,” and “successful” are in parallel, and it implies how Kelly thinks men think of an ideal man. Women in engineering are considered as smart, which is not a characteristic for attracting men who are supposed to be “in control” by beating women with smartness.

These views demonstrate a general perception that engineering men do not want to date engineering women because engineering women are smart (maybe smarter) and this threatens men. As informants point out, relationships are deeply associated with the cultural belief about genders – men should be successful and in control, and through dating, the conceptions of masculinity and femininity are constructed and confirmed.

Furthermore, dating and accounts of dating describe which masculinity or femininity is legitimated. Within any one society in any moment, several meanings of masculinity and femininity coexist (Kimmel, 2000: 10). However, masculinity and femininity are understood by different groups of people in different contexts, and further, certain types of masculinity and femininity are considered significant or legitimated. Bettie, Mandy and Kelly told that how engineering women's femininity was considered undesirable for dating because it was a bit different from the expected femininity by men.

Smart and intelligent women engineering students seem to violate men's conventional idea of femininity. This also reconfirms the idea of masculinity by prescribing that male engineering students should be smart, successful and in control as real men.

Dating and accounts of dating, on the other hand, demonstrate the culture of the engineering school and women's situated-ness in the engineering school. Emma described:

Chu: Some women engineering students said engineering guys did not date engineering girls. What do think about this statement?

Emma: [. . .] in my personal opinion, civil engineers, for some reason, I don't know why, they date architects, female architects. They just like them, why, I don't have a clue, but when I was in undergrad, the majority of my friends were dating architects. [. . .] well, they kind of...they were like the cute versions of engineers. Yes, like they would be, I don't know, using fashion clothes, trying to look nice, having parties, which maybe we couldn't do because we were busy with school, you know. It's not that they were easier just that they had more time or something. I don't know, I think guys can easily date engineering girls. Maybe it's just a false image they have. 'Oh, if I date an engineering girl, she's going to be talking about calculus.' No. When I was dating, I had a boyfriend and we would never talk about that, you know, never. He was not even an engineer. We would talk about, you know, cars and sports...anything a guy might be interested in. [Ph.D. student, Civil engineering, Hispanic/Mexican]

Emma places "Architect" on the different side of engineering, and her categorization seems symmetrical. Architects are "cute," "fashionable," "look nice" and "parties, whereas engineers are not related to these things. She states that Architects are a "cute version" of engineering, and this shows that she characterizes two different academic fields in relation with gendered terms. Gendered characterized engineering and engineering women also appear in Messina's account:

Messina: [. . .] it wouldn't surprise me if an engineering guy wouldn't want to date an engineering girl. [Chu: Why not?] I wouldn't be surprised because you know, it's just some (inaudible) that these girls are masculine. You know, the

territory of engineering and maybe they're kind of turned off because you're not feminine and because you're in here doing the work. That's what I would think an engineering guy would think what would turn him off from an engineering girl. [. . .] Because of their engineering degree and not a "girl's" major, like English or social science, where they can paint their nails. That's what they would think, I think that they would think. That's why it wouldn't surprise me." [Undergraduate junior, Civil engineering, Black/Caribbean]

Messina states that engineering guys do not want to date engineering girls because engineering girls are "masculine" and "doing men's work." The symmetry of engineering – men, masculine and non-engineering – Liberal Arts, women, feminine revisited. By deviating from the normative ideas of gender and profession, women engineering students were considered not feminine and not attractive heterosexually.

Chu: Some women engineering students said engineering guys did not date engineering girls. What do think about this statement?

Nikky: It's actually kind of funny because the Sociology class I took last semester they did say that guys didn't like female engineers because they tended to be stressed out looking all the time, messy hair, sort of drab clothing, you know, stuff like that...and the guys in the room were just laughing, you know...going, 'Uh huh, that's true...hahha...' It was really, really funny. You know, technically, in my opinion if you really care for somebody that stuff shouldn't matter. I can definitely see how non engineers would think that, as far as engineering guys who do care about that sort of stuff, I'm sure it's pretty common...ummm...but then there are more problems than that...I mean, not to be mean to them, but seriously, when you think about it. I don't really know how guys' minds works but I know for a fact that that is true because I've seen it happen, and what can I say, I have to respect that but, it is true about women too. When you go to bed at three or four in the morning and you have to get up for an 8o'clock engineering class you just don't care, I mean, it's a matter of time. I think it's a matter of time.

[Undergraduate junior, Aerospace engineering, Hispanic]

Nikky thinks it is true that engineering men do not want to date engineering women because the women are not what men expect for women. Hectic workloads make everyone too busy to care for their appearance, but the idea of womanly ideals of

appearance is widespread, also in the engineering school, and it perpetuates the belief of universally existing beauty (Wolf, 2002). Women must want to embody the normative beauty standard, and men must want to possess women who embody it (Zones, [1997] 2005: 66).

Diana: You will hardly see any of them (girls in engineering) dating a liberal arts major. I think it is very difficult to be a girl and to feel that you are more practical than your boyfriend because that's just not the role that you 'think' you will have in a relationship. Because usually, I mean, not always but usually when you think about a relationship the girl is the one who, you know, she takes forever getting ready, she's the more fanciful one, guys are more practical 'Here I'm going to mow the lawn or drive my car to home depot.' I don't know, stereotypes but...the way you tend to think of relationships. So, if you're a girl in engineering you're probably...not necessarily less feminine but you don't have time to, you know, get dressed up for school. No engineers dress up for school. We always wear t-shirts and sweatpants, you know, that's just the stereotype but it's kind of true. If you watch that side of campus people are a lot dressed down because they don't have enough time to care for themselves, like that, on a daily basis, on weekends, maybe but not just day in and day out. West campus girls, business school always very dressed up. So if you're a girl like that you don't want a guy who's higher maintenance than you. For me, I would hate to be dating a guy, I'm like 'Ok, I'm ready to go.' He's like 'Oh no, I have to put stuff in my hair, spray on cologne.' It doesn't work for me. I want someone who's equally as practically me and can just be that way. A lot of guys in engineering don't like dating engineering girls because I think...in some way they like to get an escape out of engineering in a way. They don't want to be day in day out talking about school ...hahah.

[Undergraduate senior, Civil engineering, Asian American]

As shown in Diana's, there is a perception of the double standard for attractiveness: women are expected to spend more time "being attractive" than are men. Diana uses the term, "practical" as an attribute girl is not supposed to have – "it is very difficult to be a girl and to feel that you are more practical than your boyfriend." "Being practical" was used by Diana when she described what engineering identity was. She

uses this term again for describing how engineering women are “practical” compared to other women.

Engineering women are seen as more “masculine” and heterosexually less attractive in part, because they are doing “men’s work.” On the other hand, if they look more feminine, they raise suspicion. Requirements of looking both engineering-like and feminine actively marginalize women engineering students. As suggested in the studies about professional women, if one appears professional, one cannot be adequately feminine; if one appears feminine, one cannot adequately conduct professional tasks (Valian, 2000; Meyerson, 2003, Zones, [1997] 2005).

This inconsistency characterizing women’s locality in the engineering school is more aggravated and obvious in dressing.

Dressing/Clothing

Clothing is a way to present self-image and an identity as a member of an organization. During the interview, when women engineering students talked about dressing and clothing in engineering school, they usually said that the dressing issue was “interesting” or “funny.” They laughed a lot, or some of them said it was hard to explain but they thought the problem was there. Engineering women said they once had strange feelings about dressing to go to school, and these feelings made them think or reflect on who they were or how they behaved as women.

Chu: A woman engineering student said she worried about what to wear for school. Do you ever think of this thing before?

Eli: It’s only been a couple of years or so...or maybe a couple of years that I started thinking about dressing when I go to school, or dressing when I go to work in an overtly feminine way. I never used to wear skirts to school, for example, and I do now. And I’m not sure I ever really thought it through as ‘not

wanting to stand out,' but what you said just now sort of resonated with me, because when most of your classmates are male, if you wear, you know, cute little skirts and you know, pretty silk blouses and stuff like that, you look different than most people around you, because probably most people around you are going to be guys in jeans and a t-shirt and stuff like that. So there is sort of an unconscious drifting away from that. [. . .] So I think that there may be an unconscious pressure.

[Ph.D. student, Civil engineering, White/Anglo American]

Because most of the classmates are male, if a woman student dresses in feminine way like "cute skirt" or "silk blouses," she "stand out" and "drifts away" from the majority. Eli mentions it is an "unconscious pressure" for women to be like the majority, men.

Gwen: Yeah, I still dress like a student, like an undergrad sometimes. [. . .] Mostly, I just try to look around at others, my fellow students, and I just try to fit in, like blend in, you know, you don't have to...you can stand out you can be like, wearing pink hair or something if you wanted to, but, I think its still a college campus and there's going to be people who may look at you and say..., you've got to be yourself to a certain extent, but umm, yeah, I think most of my fellow students they just wear jeans and shirts which is just normal and that's what I wear most of the time, just jeans and a nice shirt or something. [Master student, Chemical engineering, Black/African American]

Gwen clearly states there is recognition of what other engineering students wear and trying to "fit in" or "blend in" them. Jeans and shirts are "normal" for engineering students. Dressing and blending also appear in Teri's account:

Teri: [. . .] you're very visible, you know, everyone knows who you are...you know, and that's, that's a tough situation to be in after awhile. It doesn't make you paranoid, but it's like...it's like when you're in a group of people all the time and it's you one person to ten or twenty people that are completely similar, you begin to feel it after awhile and you know you're visible, you know...it makes you react differently to situations, I mean, it puts you on a defensive...it puts me on defensive, I don't know if it puts everyone on a defensive, but it, you know, it does, after awhile it really does. [. . .]"

[Ph.D. student, Nuclear engineering, White/Anglo American]

Dressing is a particular venue for women to demonstrate how they “fit in” the “normal” engineering standard or “blend in” the engineering culture. They sometimes express concern about what to wear for school so that they do not “drift away” from other engineering students. This sometimes yields women to “react differently to situations” in engineering, as Teri states. The concern about blending in the majority engineering culture puts Teri on the defensive and it demonstrates that engineering women are located in the marginalized position in engineering.

Other women engineering students said they did not want attention because they already receive enough attention in engineering.

Chu: An engineering woman student said she bought baggy jeans and flannel t-shirt for working as an intern in an engineering company. Do you ever think about what to wear?

May: Yes. Hahahah...umm...I try and do the same thing, that's kind of funny because I like to wear big t-shirts, look at me, this is a rare occurrence that I'm actually wearing shorts...because just being female, in a big group like that, you're already getting enough attention, you don't want more...unless, you're that kind of girl, but, yeah, big t-shirts and jeans kind of draw the attention away...definitely, you don't have to try for attention, being female and in an engineering course...so...I don't know, does that answer it?

[Undergraduate junior, Electrical engineering, White/Anglo American]

“Being a female” in the engineering course makes women engineering students consider how to “draw the attention away.” This attention is unnecessary because it brings sexual attraction into engineering.

Bettie: Oh yeah...I wear jeans and t-shirts everyday. It is distracting. There actually is a girl, and she even distracts me. There's a girl in one of my classes who, you know, wears pink everyday, she put bows in her hair, she brings a big purse to class, and she's always matching and everything, and it's distracting, it really is. Umm...just like girls who sit there in class and play with their hair

everyday, it's distracting. You're, you know, you're not used to seeing that in all your engineering classes because it's guys and what do they...all they have is to rub their hair or something, you know...hahah, because they have really short hair. But I wear jeans and t-shirts just because, like, it's...there's no reason to dress up. It's acceptable, everybody dresses down as opposed to when you go to west campus here, at the business school, [. . .] but, I don't, I wouldn't do it. I don't necessarily want to stand out to the point that I'm wearing bright pink shirts and stuff to school because there is no point. Especially since if you dress nice...I'm afraid if I dress nice to engineering classes. That's like the only girl, couple of only girls that guy is going to see a day and he'll come over and be like, 'Hey, do you want to go out sometime, blah, blah, blah,' when that's more undue attention that I don't want or need. Especially...even more so because I have a boyfriend, so...why even bother, there's no point dressing up. I'm not trying to attract any guys or anything.

[Undergraduate junior, Petroleum engineering, White/Anglo American]

Engineering women said they already stood out just for being a woman in male-dominated area, so dressing different from guys seemed to achieve unwanted attention and make them look more different. Undue attention by being different from other engineering guys evokes the gender identity of engineering girls, which is supposed to be suppressed to be a regular engineering student. Bettie demonstrates an understanding of what dressing up means both to the men and to the women: it is seen as a signal for dating, for being available. So the girl who wears pink and bow in her hair is "distracting." For Bettie, there is "no reason to dress up," because she already has a boyfriend. By dressing in a feminine fashion, engineering women would be considered as only women not engineers.

During the interview, the researcher mentioned that a woman had told her that she was struggling to find "appropriate" dress for school. This prompted a discussion within some of the focus groups:

Thelma: You better not have on jeans that fit, not tight jeans, just jeans that fit.

Cause I do not like big jeans, if I got on big jeans it's because I can't afford tighter ones. So I had to buy big clothes the first week I worked there I went to target and bought everything out of the men's' section. I bought men's shirts which means my buttons were on the wrong side. I bought men's shirts, I bought men's jeans everything. [. . .] I am serious. Steal toed boots I wore flannel shirts. Never in my life have I worn flannel shirts. I had to buy flannel shirts and I had to buy large jackets to cover my self up, I'm serious, and a hard hat. I had thick shades that would come all the way around my face. Because other wise you are not getting any where. You are not taken seriously." [Focus group1, Undergraduate senior, Black/African American]

Women are consciously or subconsciously coerced to project themselves as competent and effective in the workplace (Zones, [1997] 2005: 74). Thelma emphasizes how she intentionally changed her dressing style to be "taken seriously." In her account, her dressing style is depicted in detail – big jeans, buttons on the wrong side, steal toed boots, flannel shirts, large jackets and a hard hat, and this shows how she changed her into the masculine style dressing for being an engineer. In many of the situations these women find themselves in, there are two issues: one is particular properties of the job and the other is decreasing the emphasis of their femininity.

Bunny: I mean, I did that personally, because I want to be judged on my work. I don't want people looking at me as 'a girl' or being attractive or looking prissy. I don't want the company to be like 'Oh, Bunny had to do her makeup today to drive around in the dirt,' you know what I mean? Even though, I mean, that's no big deal. You can't judge someone on their makeup. I understand that but, I wouldn't want that to even be like an option. I wanted it to just be like 'Ok, I'm here for work and that's it.' So, that's why I personally did it because I do, I feel that we give off that image and I don't want to. And I guess that is true, like a lot of women are suppressing their femininity because of work. But, totally, I did the same thing that's why I laughed when you said that, I couldn't believe it. [Undergraduate junior, Petroleum engineering, White/Anglo American]

Julia: Sometimes (I think of what other people think of me), but not in the way I dress, more in the way of how my ideas are presented. I always want it to seem like I'm as smart as they are. That's what I care about, not the way I look. More about how I come across, how intelligent I am. [Undergraduate senior,

Civil engineering, White/Anglo]

Women engineering students tried to project a legitimated image of themselves as engineers to others. They were concerned, in part, because they recognized that they could be seen just as “girls” not serious, intelligent, and able engineering students. As engineering women’s accounts demonstrate, sometimes consciously and sometimes unconsciously (until the issue was brought up) they recognized how their femininity was perceived and how gender was salient for organizing the engineering context.

The consideration of femininity and the process of organizing the engineering context are political and they are relevant to gender stratification. Interviews documented that the women noticed the presence of femininity existed as a subordinated identity in relation to masculinity, so some of them strategically “suppressed” their femininity in order to achieve the same status as men.

In this sense, some felt there was a normative cultural standard for dressing in the engineering school. Mandy said:

Mandy: [. . .] but I think that’s a problem with their mindset, not mine. The thing is if they were in a liberal arts class and I walked in dressed like I’m right, but I see it happen all the time...engineering guys with their girlfriends, you find out their majors, elementary education, sociology, psychology, whatever liberal arts, and it’s okay for them to dress like that, but because I’m (in) double-e (Electrical engineering), apparently I’m not supposed to dress do that. I’m supposed to be pretty much asexual, hahah, I’m not...that kind of thing bothers me.”

[Undergraduate sophomore, Electrical engineering, White/Anglo American]

Mandy addressed that the engineering culture prescribed female students to dress in a certain way that projected themselves as “asexual.” In engineering school, dressing

“normal” meant wiping or suppressing the inappropriate identity, femininity, and adopting the legitimated one, non-femininity or masculinity.

Dressing, as a moment of engaging in femininity, demonstrates how gender is constructed as a part of interactional process (West and Zimmerman, 1987). In the engineering women’ explanations, dressing is a way to present their heterosexual femininity to men.

Diana: This is actually very interesting. I don’t think of myself, you know I’m wearing jeans and a t-shirt, but I’m not like a free t-shirt kind of girl. [. . .] At some point I just realized that, you know these people, especially after I had my boyfriend, I was like, ‘You know, I’m going to school with these guys. They see me all the time in lab when I’m covered in concrete and dirt. They don’t really care what I look like. I work with them all the time at night time when I come from the gym, I’m all sweaty. Why am I dressing up for school? Who am I impressing? [. . .] So after a while I just thought, it’s really not that necessary. [. . .] But a lot of it is the fact that if you do dress up for school people will say, ‘Oh, do you have an interview today, why are you dressed up? Is it your birthday?’ Because it’s just so abnormal, no one ever dresses up. I remember one day all the girls in civil engineer decided to pull a prank. We sent emails to everybody and said ‘Hey girls, tomorrow we’re going to dress cute for school just to throw the guys off, ok? All of us.’ And this really really cracked me up [. . .] Half the girls who got the email were dressing cute, like business school girls, the other half were dressing in business casual because that’s their idea of dressing up. Because as an engineer we think ‘dress up’ you think I’m going to a company brunch, I’m going to meet someone in the industry, I’m going to meet a professor, I’m going to meet the department head, (so) I need to be in a button up shirt and black pants. So half of the girls are dressed, I guess, in what you would call ‘fun clothes’ and the other half were dressed up like they have an interview. All the guys are like ‘Do you have an interview today, is that what it is.’ and the girls were like, ‘No, we’re just dressed up.’ They’re like ‘why are you dressed up? That’s weird.’ You know, it’s just...they don’t expect it. They’re used to seeing us in a certain way. They’re not opposed to it, I just think, you know, they just don’t expect it. If everyone in the engineering school decided one day that all the girls were going to dress up and that we were going to do that from now on they could set a new standard but it takes a lot more time so that’s probably not going to happen...hhahaa.

[Undergraduate senior, Civil engineering, Asian American]

Diana's statements illuminate the complexity of dressing for women in the context of engineering school. Dressing up for "impressing" guys connotes that women's gender identity, femininity, is constructed by doing or performing through interacting with others (West and Zimmerman, 1987), and at the same time, femininity is constituted in the relation to the masculinized context of engineering school. Her story about the email is revealing for two reasons. The first is that the norm for dressing "down" is so completely revealed. An email instructing the women to "dress up" is a clear indication that it would be out of the ordinary. Secondly, it reveals that there is some ambiguity about what "dressing up" meant. This also addresses the engineering context, because "dressing up" to, for example, meet someone in the industry involves wearing more formal clothes, but not more "feminine" clothes. The other kind of "dressing up" is dressing more "feminine" or "fun."

Gwen made similar points about the ambiguity of dressing in engineering:

Gwen : uh huh...he (professor) didn't say me in particular, but he said something like, 'Some people wear shorts to class and some people don't even care about what they wear,' something along that and after that...I don't know, this is when I was in grad school. I think that when I started grad school, my graduate course work...I think that as a graduate student you're expected to dress as a professional as much as possible. I mean, you're still a student and you're surrounded by undergrads so dress whatever...but you are a student and your professors will look at you as a professional because that's where you're going. I think that's important, I don't think that's a bad thing necessarily. I don't think that women should try to hide the fact that they're women and wear baggy clothes or something, but I think that you should be respectful of your peers and your professors. That's something I'm still working on...hahah [Graduate master student, Chemical engineering, Black/African American]

Gwen is "still working on" how to dress for school. She wore shorts and she felt her shorts were not considered appropriate in the engineering graduate school. She

was thinking about dressing “professionally,” but she still felt professional dressing might be not matched well with the “student like.” So, Gwen is still looking for the way to dress for both keeping femininity and receiving the respect from other engineering students.

On the other hand, the currently shared idea of femininity is developed through competing with other girls for beauty.

Debra: Yeah, it’s funny that you said that because my roommate is a business major and we dress completely different, like this. Ok, for the longest time for a year straight, I kid you not, every single day I wore t-shirt and jeans and it wasn’t until my senior year and my fifth year where I actually started, I guess, ‘dressing up’ like wearing a blouse or skirt or cute flip flops and I think it’s just because we’re on two totally different sides of campus and it’s two totally different worlds. So I think girls may feel more comfortable to dress this way because all the guys dress this way. There are less girls so there’s less competition for fashion, but if you go over to Wehner, on the business side, you know, girls wear the cute little skirts and the halter tops and their hair is done and their makeup is done, and that’s everyday life. And so when me and my roommate talk she’s like, ‘Sometimes I hate the way you dress...du du du,’ and so when I go to school ‘dressed up,’ people say, ‘Oh, Debra, you look really nice today,’ you know, because everybody else is in jeans and a t-shirt. I just simply think it’s the fact that there’s less girls in engineering so there is less pressure to be fashionable everyday because there’s less girls to look at...so that’s what I think. [Undergraduate senior, Electrical engineering, Black/African American]

Diana earlier said girls dressed up for impressing guys, but, at the same time, suggested by Debra, girls dressed up for impressing other girls. Both of these comments reflect that how heterosexual girls internalize the normatively standardized conception of beauty (Zones, [1997] 2005; Wolf, 2002). Heterosexual women compete against each others to embody the currently shared conception of beauty for being selected by

heterosexual men. Competing against girls for looking pretty means less diverse ways to look attractive and consequently limit the variety of differences within femininity.

Femininity Game: To Be Feminine or Not To Be Feminine

Dressing and clothing is a part of everyday trivial practices, but for an individual, it is a significant way to present how much they are “involved in” the group culture, and how much they belong or identify as “one of us.” Although many of the women were initially surprised at questions about clothing, almost all of them had stories about how they had been thinking about it. In thinking through the issues, they clearly distinguished why it might be important to “dress down.” While talking about the experiences of clothing, some informants tried to separate womanhood or femininity from engineering, addressing “girly” appearance as an apparent symbol of drifting away from engineering.

However, at the same time, informants talked about feeling strange and ambivalent. To achieve respect, status, and legitimacy as a member of engineering community, engineering girls practically diminished certain characteristics of self, and this lead to the mixed and ambivalent feelings. Maali said:

Maali: [. . .] and the fact that once I was in engineering school I felt that I couldn't dress, you know, like all feminine and everything. I felt like I should just stick to jeans or slacks or khakis or something...so I could fit in with the rest of the guys, you know, but I guess, I got closer to graduation and everything, and I was like, 'Ok, this is crazy,' and I started, you know, dressing up more and everything and just being myself...so... [. . .] Yeah, yeah I do think about that. It's like...I guess, like the first time I meet somebody new or like when I first came here, you know, like the first day I didn't want to be overly dressy or, you know, feminine. I wanted to make sure, you know, people didn't think I was girly or something, (I wanted) that they recognize me being, you know, a smart engineering student like them. So...so I do, I do think that people will look at you as kind of how you dress too, you know, kind of like a first

impression, so I didn't want to come off as too feminine. I mean, I still wear stuff, but I didn't do it like the first day or anything. I wanted to make sure that I was kind of normal or fit in like the first day or so and then I can (inaudible)...hahaha [Ph.D. student, Chemical engineering, Black/African American]

Maali thought sticking to jeans for "fitting in with the guys" was "crazy" and tried to dress in her way, but she was also concerned not to be feminine or girly because presenting the self image girly or feminine might conflict with the image of a "normal" engineer.

Nikky: Well, that was just the thing and part of it...no, I don't care, the answer to the question is no. It's a philosophy that I've picked up and then tried really hard to abide by, but then in a way I sort of do care. So it's kind of mixed because there is both...but, for the most part no, simply because life is easier that way. If you don't care about what other people think of you then you're pretty much free to do whatever you want, you know, within reason, but you don't have to worry about anything and it just decreases a lot of worry. [Undergraduate junior, Aerospace engineering, Hispanic]

Regarding dressing, Nikky said, she was not concerned with what other people thought of her and what to dress for school, but she actually did care. Engineering women have feelings of deflection because they are located in the situation continuously evoking the salience of gender, but simultaneously they encounter the situation, in which their gender, femininity, in the subordinated or inferior location.

In battling between maintaining femininity or dropping femininity, some informants asserted that they did not want to acculturate themselves to be like other engineers, and wanted to present themselves differently.

Julia: In a way ...I was brought up in my household just to dress yourself nicely, don't have to go out and be really dressed up, but at the same time always fix yourself up and look presentable when you go out, but every once in a while I

feel like I'm overdressed because especially a lot of the women they aren't very casual when they go to class. They might go to class in pajamas or something, but that's just not me. I wasn't raised that way.....myself, I can't do that. But sometimes I do notice that a lot of them aren't dressed very casually. I just kind of go with what I want to wear, I try not to follow what everyone else does.
[Undergraduate senior, Civil engineering, White/Anglo American]

Nikky: See, to answer that question (of dressing), it's kind of specific to me because I have declared myself as a tomboy so, I never think about clothing. I tend to put on whatever is clean...hahha,...umm...but, color coordinated.
[Undergraduate junior, Aerospace engineering, Hispanic]

The strategies are various: one is not to follow “their rules”; and the other by identifying herself as a “tomboy” and purposefully dressing in color coordinated ways. Their different styles may be ambiguous and uncertain strategies but they both achieve the objectives as Giddens (1992) might argue of obtaining emancipative moment through everyday social experiments.

On the other hand, some engineering girls declare that they dress up to go against their rules. Bela said:

Bela: I can't imagine dressing down because of what other people are going to think. One of the lowest number of females in our department, I'm pretty sure, but I've never dressed down because somebody is going to say something. In fact they get onto me all the time because... 'why are you so dressed up? what are you doing?' [. . .] I'm not going to dress down because there are guys in the classroom. I mean, that's a reason to dress up, I would think, because there's guys in the classroom. I guess I'm opposite of her, very extreme opposite. [. . .] She should dress up and get those boys to look at her or something, if she's worried about what people are thinking. I wouldn't dress down because people are going to look at me differently. If you're going to do anything dress up so people will look at you in a good way.
[Undergraduate junior, Petroleum engineering, Black/Nigerian]

Bela is using dressing up in two different ways. One is to declare her heterosexual femininity, to achieve people's, particularly men's, positive attention. The other way is

through a status declaration: you need to dress up so “people will look at you in a good way.” Bela also said:

Bela: I dress up a lot, but I have a tomboy side as well, like I’ve always been into building this and messing up that, you know, destroying things with a jack hammer, mowing the lawn and stuff like that or doing sports. [. . .] I mean, I see that a lot of times in the engineering field but at the same time we know how to act like women as well. I’d say the advantages are you get to be treated...they treat you nicer than everybody else...they treat you nicer than the guys, they respect you a lot more.

[Undergraduate junior, Petroleum engineering, Black/Nigerian]

Dressing up is an advantageous strategy for Bela to construct her own engineering identity. She describes her choice among alternatives – tomboy or dressed-up girl. She recognized what to do or what other people expected her to do as an engineer or as a girl, based upon her knowledge of themselves or others. Thus she could act to create the most socially desirable situated identity for herself (Alexander and Lauderdale, 1977).

Some of the women talked about the distinctions between “brains and beauty” or attractiveness and then specifically reject it, while, at the same time acknowledging it.

Zena said:

Zena: Because my actual idea of a woman in engineer is being able to walk in the room and be the most beautiful woman ever, or something and everybody would be stunned by your appearance and how great you look, but then, when you leave the room everybody would know how professional you are, how smart you are, and just combining those two things is probably going to be a really successful future for myself. [. . .] I saw women being like that, they become less feminine in order to blend with the crowd. I don’t think it should be like that, because a woman should be a woman no matter where she is. And if it’s an engineering field, you have to understand the sacrifice. I (do) not exactly a sacrifice, it’s like, you have to understand that sometimes you’ll be expected to look different than you are, but I don’t think you should have to lose your identity, in that sense, because every woman has to have a female identity,

a feminine identity, and I would rather dress up everyday, [. . .] I consider myself still a feminine girl and I really like that, but I would never just wear a t-shirt in order to blend in. [Undergraduate junior, Petroleum engineering, Asian/Kazakhstan]

Emma: Yeah, I think at some point it crosses your mind...to me it's not too critical. I think I prefer to look different actually. Not to mingle in or look the same. I guess, as I mentioned before, once I went to all those conferences with all those women in engineering who looked, in my opinion, very bad. I just decided 'oh no...I will never be that way.' Because, I mean, it's sad. They're so smart but they look so bad. I mean, they're able to have good things. I think I like to dress different, I mean, I don't care (others' opinion). I don't intend to mingle. Of course I wear jeans because it's more comfortable but I don't plan to be like 'oh, let's hide behind this t-shirt and don't pretend like I'm a girl'...no, whatever. And actually I feel fine sometimes. When I work in the lab and it's physical work and then some other guys come back complaining 'Oh, it's too tough.' or 'I'm tired.' I even feel good, like, 'Oh, you know what, I was able to do that and you're complaining now.' It was hard but, you know, you're sounding like a girl now. Complaining about all this hard work and it just feels good, well in my case, I just feel good and I don't care how I wear, you know, what I wear. It's fine. Hahaha." [Ph.D. student, Civil engineering, Mexican]

Zena emphasized how maintaining femininity was important and she argues that she should dress up to keep her feminine identity. Emma also declared why did dress appropriate to a masculinized engineering context, and preferred to look different from other engineering guys. Both of them chose to stand out and accepted their ambivalent situation. Emma, particularly addressed that she felt fine and even good while she handled conflicting aspects of her identity as a woman engineering student.

Some engineering women were actively creating the most desirable identity, that allowed them to feel good, in terms of the knowledge they developed through experiences. By questioning "Why should I loose my femininity?," some of engineering women challenge the authenticity of the masculine engineer identity.

However, dressing-up in engineering school is somehow risk-taking and dubious because this strategy can be interpreted as reconfirming the binary gender schemas. Quoting Naomi Wolf, Zones ([1997] 2005) asserts that trying to be beautiful can be the “last, best belief system that keeps male dominance intact.” Women put on make-up and dress up not just for her self satisfaction but for meeting men’s desire. In terms of this notion, the strategy of dressing up may contribute to enhance the gender stereotypes prevalent in society.

Additionally, as Zones suggests, their dressing-up strategy corresponds to the idea that “the closer women come to power, the more physical self-consciousness and sacrifice are asked.” This strategy may let engineering women fall into the trap of being a perfect professional woman who is congruent to the normative expectations of both, heterosexual woman and work.

Nevertheless, the complexity of dressing-up or looking beautiful strategy should be acknowledged. Women in engineering are in the double bind situation, coercing women to have a legitimated engineering identity by opposing femininity, and challenging women to be different from the dominant cultural ideology of engineering by being feminine.

In Kanter’s study about women in corporation, individuals in the subordinated positions behave less authoritatively, less powerful, weak, and more feminine (Kanter, 1993). In the business context, behaving in feminine ways symbolizes lower status and less powerful. Similarly (but slightly different) in engineering school, behaving

feminine is “not engineering-like” as well as “challenging to the normal engineering-ness.”

Women in Engineering and Social Construction of Gender

Gender is constantly being constructed at different levels: individually, gender means someone’s attributes accessing the social structure and interactions with others; interactionally, gender means an on-going accomplishment through interactions; and structurally, gender means a social ground where gendered attributes access and interact to accomplish or re-accomplish gender. The meanings of gender at each level are deeply connected, and this complicated connection can be elucidated through examining women’s situated-ness or locality in engineering schools.

Women experience conflict and deflection in the engineering school since their social situated-ness is inconsistent with engineering locality. Through various sources, women have developed their identity as woman as an on-going process, but this identity turns out opposite or subordinate in the engineering school. Experiencing this conflict and deflection, women engineering students sometimes bend their intention to stay or leave engineering; sometimes they chose the careers possibly congruent to their social situated-ness; sometimes they criticized “girly girls” and are feisty and aggressive to get legitimated; sometimes they felt strange about dressing for school; and sometimes they argued about why there were only two distinct types of women in engineering.

In the engineering school, women struggle to establish social desirability or legitimacy of the identities – gender and engineering identities they possess. Constructing identities is interrupted by power relations. In engineering, there is a

boundary for being real engineers versus “others.” Students are involved in clarifying boundaries between “a real engineer” and others. “Girly girls are not real engineers.” To construct clear lines of demarcation between the real engineers and others, femininity and less masculine subjects, such as Liberal Arts, are repressed, disdained or despised.

The dominant image of engineers and their characteristics are constructed by engineering practitioners through differentiating women who possess “other” characteristics. In this process, the dominant conceptions of femininity and masculinity are simultaneously constructed.

4.3 Theme III: Challenging Engineering; Women’s Resistance in the Engineering School

Individual identity is constructed through interactions with others and in relation to the social structural context. Women engineering students encounter challenges forcing them to consider what it means to be a woman in engineering. This challenge comes from their unique *situated-ness* or *locality* in engineering school, a male-dominated domain. Women’s social situated-ness – what women have learned from being a woman in this particular society and culture – often does not coincide with engineering or engineering organizations. So, the challenge results in conflict or deflection in the engineering identity construction process. Engineering women are navigating between to being engineer and being woman. And, through their accounts and their actions, they define and redefine what engineering is, what an engineer is, and what a woman is.

Building identity is an active process. Engineering women do not just accept their gender identity, femininity, and engineering identity as given attributes. In negotiating between the normatively assigned femininity and the masculinized engineering and engineering organizations, engineering women are (sometimes consciously and unconsciously), seeking their own spaces and forms. As Leblanc (1999) claimed, one can paraphrase Karl Marx, as implying that “engineering women may choose their definitions of women engineer, but not just as they please, because they do so under circumstances inherited from the past.”

Talking about how to dealing with the disadvantageous characteristics of ethnicity and gender motivated her to stay in engineering, Emma stated:

Emma: Hispanic communities in general, or I would say Latin American, not only Mexican, we have a very masculine dominated society. Like, guys have predominant roles and girls should conform. That’s the basis of the society. And when you’re growing up in that set up and being a female, it’s already a disadvantage. So you’re kind of get used to this fighting against the extreme types of scenario that you’re always kind of motivating yourself to supercede, to be better. And I think that creates some kind of resistance in you, like you kind of get used to it. So, when you get into engineering school, it’s kind of the same thing, in a different sort, but it’s kind of the same mindset, like, ‘Ok, this place full of guys who think I’m not worth it.’ So I have to make a statement, ‘Yes I can do this.’ So, the fact that you’re already used to that, since you were growing up, makes you better, I guess, improves your chances of being successful. [Ph.D. student, Civil engineering, Hispanic/Mexican]

Engineering organizations reflect fixed demarcations between masculinity and femininity, men and women’s professions, and expectations for men and women. So the engineering organizational context is consistent with the society. According to Emma, she is used to the fight of having to say “yes, I can do this”; she has been toughened by her previous experiences. In particular, she is arguing that because she comes from,

what she describes as a very masculine dominated, Hispanic community, she is made stronger and it has improved her “chances of being successful.”

For these women, resistance means creating ways to challenge the dominant models of engineer and normative standard of femininity. In the system asking to be either engineer or woman, engineering women seek strategies for standing “in between” by being different from the expectations of both. The resistant strategies are based on the reflected speculation of the self relating to the social institutions (Giddens, 1992), and the deflection feelings (ACT) caused by the spatial uniqueness of the agent (Smith, 1999).

This section explores how women try to resolve the paradox of femininity and engineering masculinity. Engineering women discursively and behaviorally reject the conventional idea of engineering and engineers, and reconceptualize the alternative image or style of women engineers.

4.3.1 Diversity in Femininity

In an earlier section, some women engineering students said they hated girly girls or girls who highlighted their gender (femininity) by complaining how such girls were treated differently, often as needy. On the other hand, there were some women engineering students said that they hated to be one of the guys or “manly” women engineers. When people do not allow diversity within one identity category, such as woman or engineer, when people internalize the binary demarcation of such identities, when there is only one possibility to be either engineer or girl, particular types of girls can be criticized and then excluded.

Responding to this zero-sum argument, some women engineering students suggest rejecting both approaches or doing something different by being both. Their ideas are more flexible than the fixed asymmetrical notion of identity of woman and engineer.

Responding to the question, if she ever felt different from other engineering students, Diana said:

Diana: Probably most engineers, not the ones that I'm friends with but, probably most engineers are typically introverted, quiet, problem solving, they like to keep to themselves, do their work...end of story. I know that their types are out there but I'm not friends with those people because I'm not like them. So I tend to, probably the people that I've made friends with in my field are the people more like me. I feel comfortable with them since to me, you know, they are outgoing people who have other interest. They're very good about managing their time and being successful in school. [. . .] my best friend...she's in chemical engineer, she's not quiet, she's actually very extroverted, very social. But the thing is everybody's different. She's very religious and I'm not, but we're still friends. You know it's just...you meet lots of different kinds of people. I don't really think there's one type of engineer. [Undergraduate senior, Civil engineering, Asian American]

By emphasizing individual differences, Diana suggested multiple types of engineer identities compounding several incompatible elements of the identity. In Diana's account, a "typical engineer" was "introverted" and dedicated only to the engineering work, on the other side, there were groups of people who are "extroverted," "social," but also successful in engineering. Diana identified typical engineers as "them" and "those people" and actively identified herself as "different from them."

When asked to describe images of engineers, May stated:

May: umm...hahah...it depends, I don't count myself as the stereotypical engineer, I think...umm...because my image of a stereotypical engineer is somebody, you know, real nerdy, says weird things at weird times, not very

social, kind of reclusive, not somebody I want to be, you know. I see myself as somebody who's outgoing, hardworking [. . .] I don't see myself as such a geek...maybe I am, I don't know...hahah...and I'm fine with that, if I'm a dork, whatever, that's ok. Yeah, there is definitely a stereotype and then there's people who break the stereotype, and I've seen there is lots of people, in my class, that are very stereotypical and they say the most random, weird things, that they're geniuses and then there's other kids that are, you know, they're normal and they just happen to enjoy it and they do well in it...it just depends, it kind of depends. [Undergraduate junior, Electrical engineering, White/Anglo American]

In May's account, stereotypical engineers looked similar to Diana's description. Comparing to Diana, May did not actively identify herself as a different kind of engineer, who broke the stereotypes. In her account, she "might be" a typical geeky engineer and there were "other kids" who were not weird, so "normal," and breaking the stereotypes of engineers.

To break the stereotypes of engineers, women engineering students seek their ways. Wandering between the boundaries of engineer identities, women engineering students claim that women do not have to be the typical geeky or nerd engineering guys or follow the traditional image of engineers.

May: Umm...this is going to sound so stereotypical, but, a lot of them (engineering students) don't care about appearances and social interactions. It's like their whole focus is engineering...not to say engineering, but being a nerd, you know, and I kind of like to think of myself as a well rounded person and I like to be with people on top of being an engineer and I'm living life and I'm experiencing things and I'm getting out and I'm not closing my mind up to various parts of life.

[Undergraduate junior, Electrical engineering, White/Anglo American]

May described “them” as people devoting themselves solely to the engineering, and comparing to them, she identified herself as a “well-rounded” person. Mandy suggested unusual characteristics of engineers, being social and communicable:

Mandy: Umm...well, you know, (a successful engineer is) having a stable job and being successful in the field, but I think a really successful engineer is someone that knows, knows their stuff. You come to them with a question and they tell you, they know all the technical things. (But) they're not just the 'technical' person...the classic, sitting in the corner with thick rimmed glasses and pocket protector. They're able to be social, they can talk to people, communicate their ideas. That's something that you don't necessarily see in a lot of engineers, especially older ones. I think it's getting better, but I think the big thing is having somewhat of a communication. If you have the brightest idea in the world but you can't tell anybody...it doesn't make a difference. [Undergraduate sophomore, Electrical engineering, White/Anglo American]

Mandy emphasized “communication” to do engineering “better.” Breaking the stereotypes of engineers, engineers can be “social” and “communicative.”

Diana: If you're a motivated individual I think this is a very good kind of field because umm...balancing your engineering...umm...technical skills with people networking skills with a little bit of business skill and of course time management. [Undergraduate senior, Civil engineering, Asian American]

Women engineering students often wish to break the stereotypical image of engineers – geeks and nerds, and try to develop different types of engineers by adding their “well-rounded” personality or “social” or “networking” skills. May, Mandy and Diana's descriptions of the ideal engineer was bit different from their stereotypical or classic image of engineers. They depicted stereotype breakers by combining conventional feminine characteristics with the typical engineering (or masculinized) characteristics.

Some women engineering students specifically have considered how to blend their *differentness* into engineering effectively.

Zena: I really have considered it many times because it's like, how engineering, how is my profession going to impact my life (of) being a woman, how it's going to be affected by...how me being a woman is going to affect my career? [. . .] for me, personally, there is the big issue of how to blend my feminine side with the engineering persistence, the engineering potential, I guess...and if I'll be able to blend those two things together in the future and become successful with both of them, that's going to be my ideal future...that's when I'll know that I've reached my potential and my success as well.

[Undergraduate junior, Petroleum engineering, Asian/Kazakhstan]

Diana: There are other organizations...there are girl service sororities or you can meet people of your kind, I guess, and that way you can meet other girls who are like you and that's important. I think finding the fact that they were girls like me. There were girls in engineering and they were succeeding, they were doing very well and they were still keeping everything I thought was important, which is maybe being feminine or maybe girls who had graduated and were able to manage a family and career and those are things I look up to. I know that if they can do it, I can too. So, I think, really just kind of like learning by example. You feel really lost when there is no example, you just don't know what to do next...hahah...for girls anyway. [Undergraduate senior, Civil engineering, Asian American]

Zena and Diana said it was important to be both feminine and engineer at the same time, and that was a challenging task. To be successful in both sides, some engineering girls actively seek their feminine attributes. Bunny said:

Bunny: If you look at grades, and our professor actually said this yesterday, all the girls have better grades than the guys...it's not because we're smarter but we're more organized and we worry about things more...I mean if you just...I guess...you know, you're more nurturing, you're more conscientious of what's going on, you care about your grades and guys are like 'heh, whatever'...but like I have planners of everything scheduled out and my guy friends are like 'hey Bunny, let me see schedule, like when do we have what do' ...and I think in that aspect that gives us an edge over guys because we're so organized and I love that, I think its really good...I think I'll flourish in the field, yeah...I like it. [Undergraduate junior, Petroleum engineering, White/Anglo American]

By utilizing the feminine characters such as caring or organizing effectively, Bunny believed that girls could do engineering better than men regardless of given talent or genius. But, it is also interesting to note that she also downplays this “advantage” in a stereotyped fashion by say “it’s not because we are smarter.”

While some of engineering women suppress their feminine aspect to accommodate themselves to the surrounding, some of them consider juxtaposing their feminine characteristics to overcome the stress of being in the particular situation:

Mandy: [. . .] you have to remember that life isn’t just engineering...there’s more to it...that, you know. If I didn’t crochet I might’ve murdered somebody this semester because I can’t...I noticed this with guys too, it’s not just a female thing. You need something else, you need to stay a balanced individual or else you just, at the end of the day just ...frazzled. You need to do something for your own enjoyment. Take time out. I’m not saying neglect your studies, but take a moment for yourself and do something that you enjoy. [Chu: Do you think engineering changed you?] I think I think a little differently. I actually fixed the washer, but that was so weird. I was like, ‘I know what to do,’ hahaha... ‘I know what this is,’ that was strange. I find myself taking things apart more and looking for problems...haha...I don’t know why. I’m very frightened by it. Well, not frightened, but there’s something really scary, but I think I...I’m more interested in the problem and how to solve it than I am in just getting it fixed. Like I’d rather...I find myself now wanting to know, ‘How do you fix it?’, rather than ‘Gotta fix it.’ I want to be there with...whoever’s fixing it, I want to be there and see it, those kind of things. I think that’s the biggest difference I’ve noticed.

[Undergraduate sophomore, Electrical engineering, White/Anglo]

Mandy’s depiction of feeling “strange” and “frightened” when she behaved like an engineer and fixing the washer provides interesting insight into the process of becoming an engineer and its associated stress. Doing something as an engineer made her “different” and the difference scared her. Earlier she identified herself as a girly girl

who read Vogue and loved pink color, but here, by doing something she had not done before, she felt a sort of conflict between two incompatibly existing sides.

She also mentioned trying to distance herself from engineering to keep her balance. She tried to juxtapose two aspects of herself to survive in engineering. Her “crochet” hobby appeared as a survival strategy for Mandy in a male-dominated field by being providing a balance.

Consideration and accounting of how to dress demonstrate women’s way to challenge the dominant idea of what women should be and what engineer should be.

Emma: I think I prefer to look different actually. Not to mingle in or look the same. I guess, as I mentioned before, once I went to all those conferences with all those women in engineering who looked, in my opinion, very bad. I just decided ‘oh no...I will never be that way.’ Because, I mean, it’s sad. They’re so smart but they look so bad. I mean, they’re able to have good things. I think I like to dress different, I mean, I don’t care. I don’t intend to mingle. Of course I wear jeans because it’s more comfortable but I don’t plan to be like ‘oh, let’s hide behind this t-shirt and don’t pretend like I’m a girl’...no, whatever. And actually I feel fine sometimes. When I work in the lab and it’s physical work and then some other guys come back complaining ‘Oh, it’s too tough.’ or ‘I’m tired.’ I even feel good, like, ‘Oh, you know what, I was able to do that and you’re complaining now.’ It was hard but, you know, you’re sounding like a girl now. Complaining about all this hard work and it just feels good, well in my case, I just feel good and I don’t care how I wear, you know, what I wear. It’s fine. Hahaha.” [Ph.D. student, Civil engineering, Hispanic/Mexican]

In Emma’s accounts, the successful female engineers looked “bad” and it was “sad” because these smart women “hide” their womanhood and mingle into the men’s characters. So, “not to mingle” into these abandoning femininity female engineers group, Emma “prefers to look different” and like to “dress different.”

Distancing herself from the dominant engineer identity, however, Emma wanted to show she could do engineering like male engineering students. She did not devalue

engineering smartness of female engineers, but she just did not want to be “the same.” She also clearly shows the contradictory feelings she has when she says that when the men complain they are “sounding like a girl.”

Dressing in engineering, May suggested a way to mix engineering smartness and girly cute style:

May: If that's who she is then oh, the girl who's real smart, she dresses real cute, that's cool. The girl who doesn't do makeup and doesn't, she wears jeans and a big t-shirt, if that's what she likes to do, then do that. I kind of like to change it up a little bit, you know, if I go hang out with friends, you know, at a coffee shop, I'll dress up...not dress up, but I'd dress more girly but, if I'm going to hang out with a group of guys and work on a project, you wear your baggy jeans and a big t-shirt...it just depends on your situation. I think it's really key for women to be who they are in engineering, because they bring...they bring an interesting aspect to it, you know, they bring...they change it up a little bit when they do that...it makes it more interesting.

[Undergraduate junior, Electrical engineering, White/Anglo American]

May also juxtaposes engineering “smart” and “dressing cute” within one person. But she did not show deflection with this strategy. Her comments can be interpreted as supporting the idea that engineering students could and should construct their identities situationally. Performing femininity by dressing girly can go with performing an engineer identity by working successfully on a project with guys. This reflects how individuals possibly consider the most desirable identity depending on the particular situations.

Dressing also can be strategically used for challenging the asymmetrical relations between engineering and femininity. Earlier, some women engineering students addressed girly or feminine appearances as incompatible with the image of successful engineers. Also there were ambivalent feelings about looking “girly,” pretty, and

feminine. There was a belief that very feminine dressed women were not serious engineering students, however, some of them wanted to stand in between femininity and engineering successfully.

Emma: So, it's kind of amazing that she gets so much respect even though she has been not so long in her career. And I think she's my role model because besides all that she's not like a geek or anything, she's like super cool. She dresses very nice, she's beautiful. I mean, she's got like everything...I don't know about her personal life though, but in every other sense, she's very nice. [Ph.D. student, civil engineering, Mexican]

Della: [. . .] She is a VP of a company; she is only like twenty seven, twenty eight years old. She went to UT got her masters in double E (Electrical engineering). I mean just everything – she went to London for a year they sent her over there and she came back. She is just a prime example, she is like the Oprah of the electrical engineering world, I am dead serious. She wears the makeup she has the hair the makeup everything. She is like so sharp and so on point and I know she was not one of those girls that just sat there and was like...hmm ..I am going to skate by but I am going to look good while I am doing it, you know what I am saying? I would tell that girl just be yourself, just keep on trucking, you are going to make it just like they will. [Focus group2, Undergraduate senior, Black/African American]

Bela: [. . .] get to know your classmates, you're going to be with these people for the next three years. Get to know somebody, it's going to really, really help. Next survivor tip (for) women...would be to dress nice for guys...it's not going to hurt you, it's not going to hurt you. [Undergraduate junior, Petroleum engineering, Black/Nigerian]

Dressing up can be a way to break the stereotypes of engineering women. In Emma's account, her role model achieved the respect from the peer groups as engineer, but she was not geeky, and was beautiful. Being beautiful and dressing nice are symmetrically placed to being geeky, and her account also shows, that ordinarily, doing engineering well cannot be compatible with beauty. Della also addressed how this woman was a role model, but also how unusual this must be by comparing her to Oprah.

In Bela's account, dressing nice for guys was one of her "survival tips" for women. She mentioned that women should not neglect the feminine side of women and actively use the strength of it. Revealing the feminine identity was considered risky to achieve appropriate status in the engineering because femininity poses at the opposite side of engineering, but Bela argued it would not "hurt" women engineers.

For women engineering students, resistance is based on their recognition of what it means to be a woman in engineering. To being a woman and to being an engineer are the processes satisfying the normative standards of each site.

Bunny: I think that engineering has always been a man's field. It's always been physical labor out in the field and math has always been the 'man's thing,' like man are always supposed to be good at math, girls are supposed to be good at English. But, I think times have changed and maybe girl's don't pursue engineering as much because it was a guys field and they just didn't think that they could do it. I think now, we still have few, but not as few as two years, ten years ago. I think we're just starting to realize that there's maybe not such a starch line between men and women and math and English, you could do them both. [Undergraduate junior, Petroleum engineering, White/Anglo American]

"Supposed to do" as a woman or as an engineer has been clearly assigned to the members of each group, and there is a contrast between them. However, Bunny suggested pulling down this "stark" line by being both at the same time. Realizing the boundary between the two contrasting sides, challenging both the ideologies of engineering and femininity, and reconstructing the new norms, values, and styles are important steps in resistance.

4.3.2. Doing Engineering with Feminine Styles

Standing in between the seemingly contrasting boundaries of engineering and femininity, women engineering students seek ways to blend the conventional feminine

attributes such as caring, nurturing, and relational with those of engineering. For instance, when women engineering students talked about their female professors, it was shown how they evaluated successfully blended femininity in women engineers.

Debra: Just how hard that she (Dr. B) works and how involved she is with students and how much she really does care and I kind of want to follow in her footsteps of, ‘Yes, I can be an African American woman engineer and I can make a difference, I can be on the playing field with everybody else.’ and I admire her for that. She’s not afraid to be on the forefront. I just really appreciate her for being there for me. So, she’s a really good role model. [Undergraduate senior, Electrical engineering, Black/African American]

Mandy: I’ve only met one (woman engineering professor). All my professors have been male. And I’d have to say this lady I don’t particularly care for, hahah. She doesn’t have any kind of warmth or personality. She’s very standoffish. I wasn’t even trying to be...I think I stopped in to ask her a question, she’s an advisor for the Society of Women Engineers and I’m the summer camp co-chair, I had some questions to ask her and she just was not helpful. She was inaccessible, she wasn’t very feminine, I couldn’t talk to her. [. . .] I think as an advisor that’s what you’re supposed to do. I don’t know. She’s the kind of engineer I don’t want to be, hahaha. I don’t know. I just wasn’t (inaudible). I was afraid that’s what I might become some day, you know? I don’t know...she was lacking everything that I thought was successful...she was very smart, very smart woman (who) knew what she was talking about, but talking to her was almost like pulling teeth sometimes. [Undergraduate sophomore, Electrical engineering, White/Anglo American]

In Debra’s account, Dr. B was a role model who successfully demonstrated feminine characteristics in doing engineering. Dr. B. was strong enough to “be on the forefront” but, at the same time, she cared about her students and was “there for students.” “Not afraid to be on the front” is manly traits and “involving with” and “caring” students are the traditionally considered feminine traits. By juxtaposing two attributes within one person, Debra is constructing the unconventional image of woman engineer. Comparing to Dr. B., Mandy’s female professor did not show an alternative

image of successful woman engineer. This female professor did not relate “feminine” aspects such as “warm” “socially accessible” and “helpful” to her engineering aspect such as “being smart.” Again, in Mandy’s narrative, feminine characters exist asymmetrically with engineering or smartness, she was worried that she would have only one aspect in the future. So by evaluating feminine attributes positively, Mandy was distancing and rejecting a purely masculinized engineering.

Doing engineering in feminine styles effectively also appears when women engineering students are involved in group or team projects. Women engineering students often did not understand group activity in hierarchical terms and they did not try to exert power for controlling other group members. They frequently identified themselves as an “organizer” and evaluated the roles of organizing valuable in achieving groups tasks.

Women engineering students did not phrase an organizing role as secretarial or as a less powerful position within a group. They evaluated this role, which might be considered stereotypical women’s role in groups, positively and emphasized how this role is important in group work.

Jill: Everybody needs to be an organizer is something...it’s something that everybody needs to know as an engineer, somebody that’s able to prioritize. I think the main thing that we all need to have is field of communication, that’s a big part. [Master student, Mechanical engineering, Black/African American]

May: Umm...normally, it’s the time management. ‘This is what we have to do,’ and I set the deadline, ‘Here’s the big picture, now lets divide it up into little tasks, you get this and you get this.’ So, maybe it’s the leader...umm...but, if somebody decides to not follow through, then I take it upon myself...so, I don’t know what you would call that in a group...just by default. If somebody says, ‘Oh, I don’t really care about it,’ then I would assume it to be my responsibility, you know what I mean? I guess it’s a leadership role.

[Undergraduate junior, Electrical engineering, White/Anglo American]

Jill emphasized “communication” as a main thing to be an engineer. Communication skills have been considered as one of the conventional feminine characters, but by connecting this to being an engineering who knows how to “prioritize” things for work, communication and the organizer’s role have different significance.

“Time management” also had significance in May’s account about team work by being connected to “responsibility.” Earlier, women engineering students said, to be an engineer, students should have certain qualities such as intelligence and skill in math and science. But the embodiment of engineering is not only about intelligence but also based on responsibility about getting work done on time.

Keeping time and checking schedules seem secretarial roles that women have traditionally done for the family, group, and organization. But these are also the traits of supervisors, and women engineering students interpret their time keeping and managing the schedule roles positively.

Debra: I would usually play...I think the team leader and the timekeeper, no, the organizer, the organizer/time keeper. I’m a very organized person and I like to know when thing are due and I always have a time schedule for myself and a calendar for myself on when things need to be due. So I’m a great organizer, one time I had to be a leader for a project and it went, it went pretty good. I don’t think I would be a good devil’s advocate because, my...I see something and when I see an idea that I like I go for it, regardless, regardless if there is other cons with my idea, so I’m really not a good devil’s advocate, but I’m a pretty good leader and a really good organizer. So those are the roles that I play in each team.

[Undergraduate senior, Electrical engineering, Black/African American]

“Umm...I’d say I’m usually the one that gets us back on topic. The one thing I

cannot stand during group projects is wasting time. Especially in lower level engineering classes, the project is usually meticulously hard, so I would rather just get the stuff done then, you know, not chat, not talk about what everyone did this weekend, just get it done and we can talk about stuff afterwards, you know. But, I've had my groups before that's just no focus whatsoever and you can get off topic so easily when you have four college kids all, you know, hanging out trying to work on a project. So, I find myself to be the person who's like, 'Let's get this done and then we can take a 30min break, do whatever and hang out, then come back and do the project.' [. . .] (It) could be something like that, organizer, like, I think I help organize. Saying, 'Ok, you do this part, you do this part, you do this part. We'll all come back and put it together, write it up.'

[Undergraduate junior, Petroleum engineering, White/Anglo American]

Time keeping and managing the schedule are important abilities to make Debra a great organizer and leader, and for Bettie, keeping other members focused on the topic and dividing the tasks are important to do meticulously hard work of engineering courses.

Some of women engineering students use their relational skills actively to do their group work effectively.

Zena: Probably the organizer and the spiritual person. [. . .] I know how to find a way to inspire them, to make use of them. [. . .] Yeah, spiritual in the sense of like, I know how to approach different people for some reason. I think that's one of my skills that I've learned being here (engineering school), and you have to find a specific approach to each person, and I think I can do that sometimes and organize, even though I may not be as, I wouldn't say smart, (I) may not be as knowledgeable in the field as the person who's working, or... at least I can, I know how to approach the person in order for them to be inspired by the work they are doing.

[Undergraduate junior, Petroleum engineering, Asian/Kazakhstan]

In the "hands-on" or "physical" site Zena put the "spiritual" character for doing work with other engineering students. By spiritual, she meant the skill of finding the way to inspire group members to cooperate and get the job done successfully. Her spiritual role is not just distributing the tasks and checking the schedule. More than time

keeping, Zena recognizes how communication is important for efficient group work and uses her talent for making group members participate.

Maali also talked about what role was necessary to make sure if every member participates in the group work.

Maali: Umm...hmm...I guess I'm more of the like team player, for my team work I do. I'll sometimes take the leadership roles if I see that no one else is taking the leadership role then I will take the leadership role and try to schedule times so we can get together and work on our problems. But if there is someone else who's more aggressive and wants to do it, then I'll just let them do it. And then I just try to, you know, make sure everyone else is involved, make sure no one is feeling left out, make sure everyone is contributing their weight and everything that we're all understanding what we're doing, so that one person isn't doing it then another person copies it and doesn't know how we came to the solutions and stuff.

[Ph.D. student, Chemical engineering, Black/African American]

In Maali's frame, a good team player was described as someone who made sure if everyone was "involved," "no one felt left out," and everyone "contributed" their weight upon the project. Equal participation and contribution are emphasized in Maali's account of team player, and her style is based on cooperation.

Others also emphasized that engineering is done not by one genius but by the cooperation:

Eli: [. . .] and, number two, I think that there's a spirit of camaraderie that has developed. I interact with my professors all the time, they sort of treat me like a colleague, (and) my fellow grad students are like that too. I really like that. I like this spirit of cooperation, I like this spirit of collaboration. This feeling that there are a lot of really important problems out there and if we work together we can solve them. I think it's a very optimistic vice. I think it's tempered with a sense of realism. [Ph.D. student, Civil engineering, White/Anglo American]

When every member of the group has the same power and treats each other as “colleague,” then “camaraderie” and “collaboration” can develop. Eli saw this from the sense of real engineering life. When women engineering students talked about group work or group projects, they frequently said group cooperation turned out important for producing better consequences in engineering. Encouraging students who often compete with each other is a kind of stealth strategy. Collaboration or cooperation can be an “optimistic” vice.

While discussing their experiences in engineering school, women defined engineering identity and the components of the engineering identity. In their narratives, engineering identity was often defined in relation with non-engineering sides or something different from engineering. In between engineering and non-engineering, women and womanhood frequently stood in the non-engineering arenas, and even sometimes neglected and distanced. The components of the engineering identity often conflicts with conventional ideas of femininity and womanhood, so engineering women often had feelings of deflection and contradiction in constructing their engineering identities.

However, struggling for their engineering identities, women had chances to develop alternative ideas and strategies of engineering and engineering identity. Women in engineering school often looked for their own strategies to remove the lines between two incompatible and asymmetrical sides – engineering and femininity. Attempting to combine femininity with engineering, women developed resistance strategies sometimes discursively (saying “I am different from them” or “I do not want to be the same.”),

sometimes behaviorally (dressing up or crocheting), sometimes relationally (being an organizer or team player, or being cooperative). Their resistances were based on the conflicts and contradictions in constructing engineering identities. Resistances based on contradictions members experience in the organizational settings are also suggested by organizational communication research. Putnam and Boys (2006) discuss the metaphor of contradictions in the communicative discourses in the organizational settings. Individuals sometimes experience the on-going struggle or tensions between oppositions in the way they enter into an organization. Putman and Boys argue that this experience of contradiction highlights the interaction between oppositional forces that are situated in bi-polar relationships in an organization; hence inducing resistance and organizational changes. Through their assessment of the perspective of organizational communication, Putnam and Boys provide an alternative perspectives by viewing organizational reality as possibly transient and changeable.

Engineering women's strategies do not generally seem to be strategies of collective mobilization, except through some of the engineering organizations. But, it is significant that women viewed engineering women "in the field" or their professors as important role models – either as symbolic of success or, sometimes, as symbolic of what they did not want to be. Their strategies are also significant for organizational change, as Putnam and Boys showed. By practicing and experimenting with alternative ideas of woman *and* engineer, women engineering students are constructing alternative identities, and their practice and experiments challenge a system, which has framed engineering and woman as generally incompatible.

CHAPTER V

CONCLUSIONS AND DISCUSSION

This research originated from the question of “why are there still so few women in engineering?” Some approaches emphasize socialization arguments which argue that cultural expectations, rewards and costs, and the power of norms influence women’s academic choices in adolescent and youth periods, and subsequent career paths. Other studies emphasize the structural characteristics of society and the workplace that exclude women. These approaches are valuable perspectives. But they do not focus or detail the dynamic processes of how women actually define and construct their situation and identity in engineering. The paucity of women in engineering and their experiences as a marginalized population must be understood as an interactional on-going process of constructing the conceptions both of gender *and* engineering. Being a female engineer implies how a woman deals with gender and engineering through everyday experiences with others in given situations. Without understanding women’s engineering identity construction experiences as interactional and on-going, ambivalent or contradictory relationships between gender and engineering, can be overlooked and there is less opportunity to observe women’s day-to-day resistance.

Understanding how and what women experience in a given engineering context, has been the target of this research. Especially through their narratives, women have accounted for what it means to being women engineers and how others think of them as women engineers. Through both concrete and imaginary evaluations from others, and their experiences, women reflect upon themselves. Sometimes these accounts are

consistent and sometimes they are inconsistent and full of contradictions. These engineering women's experience of conflict and day-to-day experiences of masculine structured contexts may be amplified by the fact that these women are located in Texas, where there is, at least a perceived, cultural pressure for women to be consistent with more traditional gender norms. However, this specific cultural atmosphere does not seem critical enough to influence entry to or graduation from this engineering school. According to the Engineering Academic Programs Office at this university, women's enrollment and degrees granted in engineering are even higher than other universities in the United States⁵. So it seems unlikely that the masculinized structure uncovered in this research is completely unique in its oppressiveness or character.

Women's experiences of inconsistency and contradictions in work fields are discussed in the literatures of professionalization processes in masculine work cultures, such as business and management, law, medicine, or sciences. Many modern jobs were created based on the gendered assumptions usually invented and maintained by male workers (Reskin and Padavic, 1994). Women's experiences in work places demonstrate how their gender conflicts with the work as well as with individual male workers. As discussed earlier, women in various workplaces often experience a conflict between their womanhood or femininity and the work or culture of the workplace (Kanter, 1993; Reskin, 1993; Acker, 1990; Haas and Shaffir, 1987; Lorber, 1984; Pierce, 1995; Meyerson, 2003; Valian, 2000). Not only engineering women but also women in business, management, law, or medicine experience similar contradictions in the

⁵ See 2001 statistical report of women's enrollment and degrees granted in engineering programs: <http://eapo.tamu.edu/pdf/engr-r.pdf>

workplaces. Being a professional engineer, lawyer, business person, or physician implies confronting the masculine working culture and, by becoming professionals, women are also implicated in reproducing the masculinized conception of those professions. Struggling to become women engineers or other professionals, women confront the contradictions or conflicts, and this particular experience motivates women to reflect and often resist.

To understanding how and what women experience in engineering, first, I examined how engineering students, including men and women, described images of engineers. My survey results showed that engineers were perceived as hard-workers, busy and challenging. An interesting result was that women engineering students were more likely than men to describe engineers as hard workers. Some of this emphasis on hard work was explained through their narratives. Women often mentioned that they “proved” themselves through hard work, and that they had to work harder to achieve the perceptions of competency that were simply granted to men.

In their narratives, women delineated engineering as an arena dealing with problems of physical life and the seeking of practical solutions. “Real” and “hands-on” engineering problems, and “strict” and “limited” solution processes were emphasized in defining engineering. Women’s perceptions of engineering identity also represented the conventional dichotomy of the Western world – women and men, emotional/logical, subjectivity/objectivity, Liberal Arts/engineering, and non-science/science. Defining engineering and engineer identity was deeply related to conventional masculine characteristics or terms – hands-on, logical, numeric, and competitive. This showed that

engineering and its cultural atmosphere were based on traditional masculine attributes and terms, and through defining them, engineering women reproduced the traditional masculine conception of engineering. EPA results supported this argument. EPA scores of traditional gender segregated professions displayed the same kind of stereotyping: engineers were perceived as powerful, kindergarten teachers were not very powerful, but good.

Perceptions based upon clear dichotomies induced women to suppress “non-engineering” aspects of themselves. Some narratives demonstrated distancing from feminine attributes, and women’s organizations as representatives of femininity. This distancing did not come from just women’s perceptions per se, but interactions with other people, particularly male engineering students and professors. Overtly and covertly, significant others (family members and friends) and male engineering practitioners transmitted the idea that engineering was the men’s field and engineering women “infringed” on the arena. Additionally, neglecting non-engineering aspects from the engineering identity was also related to the hegemonic idea of masculinity. The division of engineering and non-engineering implied a relationship between masculinity and non-masculinity. Women defined engineering in certain terms and attributes, and they often connected the terms and attributes to men or masculinity. Compared with non-engineering fields, engineering was defined in specific terms, or masculine terms, and implicitly non-engineering arenas, particularly Liberal Arts were located in the “other” side or non-masculine side. Also, while they discussed dating in engineering schools, women delineated the legitimated conception of masculinity by saying how

engineering was assessed as masculine and how non-engineering was sometimes perceived as less masculine.

The competitive atmosphere in engineering also supported engineering identity in masculine terms. While intense competition was often interpreted negatively by engineering women, they often “bought into” it and their narratives demonstrated that this social practice was based on the myth of engineering – intelligence and smartness as demonstrated by “winning” or showing that “my gadget is better than your gadget” were the basis of engineering. To meet the standard of being a legitimated engineer, women more actively adopted the belief in competition and sometimes, this seemed to cause competition against other women in engineering. Engineering women contested each other for the status that men had defined legitimate.

Defining engineering identity, connecting engineering to masculine attributes and terms, and making boundaries between engineering and non-engineering, women engineering students acknowledged that engineering might not be their arena. This acknowledgment induced the feeling of deflection and contradiction. In their narratives, such feelings appeared frequently. Often, this appeared in language, for instance “I am not like ‘them,’ however it is weird to stand out in class.” Some actual practices in engineering schools such as male bonding rituals, and other people’s responses to them as engineers made women feel they were in wrong place. This ambivalence in being women in male-dominated area sometimes tempted them to justify or “bend” their intentions and referring to the conventional idea of femininity, they sometimes considered different career paths.

Deflection or contradiction is also derived from the tension between women's socialization experiences and their professionalization experiences. What it meant to be a woman (women's social situated-ness) often conflicted with what it meant to be an engineer (women's engineering situated-ness). Following the socialized gender norms often troubled women in being professional engineers. So, to diminish the conflict between women's social situated-ness and engineering situated-ness, engineering women were anxious to prove themselves as legitimated members of engineering. Besides working harder, one proving strategy for women in engineering was to become more "stereotypically masculine" by behaving in feisty and aggressive ways. By being one of "them," women reconfirmed the masculinized engineering identity.

Another proving strategy for women in engineering was distancing from certain attributes of womanhood or conventional conceptions of femininity. Categorizing femininity into two types – girly girls or one of "them" and evaluating which type would be the appropriate for being an engineer demonstrated that femininity only existed in terms of as the "otherness" of engineering. Discussing dating and dressing experiences, engineering women defined femininity and evaluated it in relation to the engineering identity. To manage the deflection or contradiction, women sometimes denied certain attributes of womanhood and selected the visible side or supported one side of the dichotomy (of the femininity) over the other.

There were few differences between the accounts of White women and minority women. However, race did seem to condition some experiences as women engineers. The survey results indicated that White women considered leaving engineering more

than men or minority women. In their narratives, minority women discussed how their racial identity could strongly motivate them to stay in engineering. As several participants stated, they already knew that they would have to prove themselves, to show somehow that they were worthy. For many White women, this demonstration of proof was not something totally anticipated.

In their accounts, minority women discussed race and gender separately in constructing engineering identity. Some of the minority women stated that race was more influential than gender in constructing engineering identity. As Stryker and Burke (2000) discuss, this probably demonstrates that one identity (race) is more salient than other identities (such as gender) for an identity set in a particular context (engineering school). The separation of race and gender in minority women's narratives also demonstrate the cultural climate in which race is only salient for minorities. Race/ethnicity surfaced and connected to the motivation in doing engineering only for the minorities. However, minority women's accounts did not always delineate a relationship of femininity and engineering identity that was different from that of White women. For example, the issue of race did not emerge in minority women's discussions of dating or dressing. Through discussing dating and dressing, women defined not only engineering identity but also femininity. White women did not relate the concept of their femininity to the race/ethnicity, and similarly, minority women did not talk about their relational experiences in engineering schools with race/ethnicity. This result was interesting to me because I anticipated that minority women might address how their womanhood and sexuality were interpreted differently by the dominant groups, White

men. Black feminists and racial/ethnic studies have argued how the images of women of color historically have been constructed and projected in certain ways for controlling their racial identity and sexuality by the dominant groups (Hill-Collins, 1998, 2005; Bonilla-Silva, 2003; Berry, 1999; Brown, 1996). Although studies show distinctively constructed femininity of minority responding to the historical and social backgrounds of a given society, in my research, minority women did not address the distinguished perception of their femininity or how their femininity would be different from that of White women. From this contradictory result, it could be argued that minority women took dating within their racial or ethnic groups as granted. Presentation of their femininity and sexual attraction by dressing and through dating is only possible to men of their own racial/ethnic groups. Dating and dressing for impressing the opposite sex within one's own racial and ethnic group do not evoke the issue of distinctively constructed femininity and sexuality of minority groups. So, in minority woman's narratives of this research, femininity was not related to race, and minority women did not consider racial or ethnic identity as critical element in explaining their dressing and dating experiences. Thus, this result reflects that the intertwined relations between race and femininity can be acknowledged and salient when the taken-for-granted idea of the relationship of race and femininity is broken.

Through this research, individual's social location and its significance to an individual and a given context were emphasized. Modern Western society draws clear lines to organize social life by placing individuals in the "right" locations. For instance, referring to physical attributes, humans are divided into two groups – male and female,

and referring to characteristics each body possesses, there are two different characteristics – masculinity and femininity. Social life is ordered based on this – among others – fixed symmetrical relationship between two arenas, often with the presumption that there is nothing in between. The concrete symmetrical relationship yields the perception of appropriate location for individuals, and, by locating the right place, individuals develop their identities. Despite many challenges to such as system, and despite individual and collective performances of “deviance,” the seemingly solid and concrete order of social life still powerfully organizes our everyday lives.

If an identity, an individual, or a situation deviates from this fundamental relationship, at the individual level, it brings a confusion, tension, anxiety and deflection. At the structural level, it is a challenge that weakens the legitimacy of the social order. Society continuously attempts to correct deviations and repress the challenges. Our everyday life is composed of battles between individuals deviating from the social order in various ways and the social structure correcting them. This battle occurs within an individual, within the interactions and within organizations. This means that individuals adopt and disobey the order of social life, sometimes consciously and sometimes unconsciously through interacting with others. In many cases, individuals do not acknowledge this battle because they are used to it or they take it for granted. However, in particular contexts, individuals encounter the situations evoking the question of whether they are in the proper space of the social order. On the other hand, this battle is always interrupted by power relations within members of the given society. The social structure compensates, compromises, and sometimes co-opts those who benefit from the

established order, or who do not want change for a variety of reasons. In other words, some individuals or certain groups who have the hegemonic power can deal with this battle differently than the subordinated groups. In this research, women's experiences of the stress, deflection, ambivalence, and conflict in developing engineering identity reflect their status in the social structure of engineering arena. As the subordinated group, women developed their engineering identity comparing men's evaluation, and continuously reproduced the masculinized conception of engineering.

Even though women were influenced by the dominant idea of engineering identity, which was invented and maintained by men, women also challenged the system or the dominant conception of engineering identity. The spatial uniqueness of the engineering women gives them what Giddens (1991, 1992) would call a moment of speculating or reflecting on the self. Engineering and the process of constructing an engineering identity create a momentum for women meeting the socially recognized "me" – women's roles and engineer's roles – and monitoring the self as an engineer based on the imagery evaluation of others. For engineering women, the process of constructing engineering identity leads to stress because engineering is not entirely consistent with "women." This, in turn, leads to anxiety.

Thinking of engineering identity and how to be a woman engineer, women sought ways to be "different" from the majority of engineering practitioners – men (and sometimes masculinized women). Even though women engineers' narratives reflected dichotomies in conventional ideas of engineering and non-engineering, they also reflected how women did not want to just adopt these notions. Criticizing the

competitive and masculine engineering culture, women often stated that they wanted to break the stereotypes. Women thought of cooperative learning and valued the organizer's role for group tasks. Women also sought the ways to preserve what they viewed as their femininity by certain acts and dress. They were trying to remove the clear border line of engineering and non-engineering within and through their everyday lives. These are the alternative ways for women to resist the situation and the structure of engineering, and it also implies building "the social" in women's terms.

Women's narratives are based on their knowledge and definition of the situations in which they are located. Through defining the situation in which they are involved, women construct "the social" (in Smith's terms). Despite their recognition and claims that "it is hard to be an engineer like guys (are)," and "it is hard to be a girl like other girls," and "it is extremely difficult to be both at the same time," they look for ways to be successful women and engineers. Some of them reconcile or negotiate between the expectations of both identities by suppressing one of them; some of them strategically draw on the strengths of both sides; and some of them experiment with alternative feminine engineer styles. These seem to coincide with Seo, Putnam and Bartunek's (2004) discussion of organizational members' strategies to manage the contradictions and tensions, for instance, by ignoring one side of the dichotomy over the other; separating two oppositional sides and let them co-exist at the same time; diluting the bi-polar pairs; or integrating the opposites.

Most of the resistance is individual and not collective, but it still challenges the system and the rules women have followed. In this way, my study echoes Putnam and

Boys' (2006) discussion of the possibility of change through the resistance of absolute contradiction. Additionally, some of the resistance is collective (women engineer associations, friendship groups, collaboration with others) and it challenges the structure by offering a network to help change traditional networks.

Through demonstrating how women struggle to construct engineering identity in their location with their terms, this research suggests several implications. First, identity construction is an on-going process in relation to other individuals and social structure. But identity is not constructed anew; it is influenced by the legitimated notion of particular identities in particular contexts. So being an engineer is a "masculine" identity simply because it has been and it has been maintained by men. Although change is possible with various ways at the individual level as well as collective level, there is a "status quo" that must be revoked. Women are still more likely than men to be employed part time and to be underrepresented in science and engineering fields; women doctoral scientists and engineers employed in educational institutions are less likely than men to be tenured or to have the rank of full professor; and women scientists and engineers receive lower salaries than men (National Science Foundation, 2003). This status quo also affects individuals in developing their identity in this given situation.

All identities, but most especially legitimated identities, develop by differentiating in-groups (us) and out-groups (others). Such differentiation makes identity more concrete and limits alternatives and deviations. Because this is the case, women, as "others" must seek ways to narrow the difference or conflict between themselves and the legitimated identity, if they wish to become part of the in-group. On

the other hand, while identities are fluid, they are not all compatible, and when incompatibility or contradiction occurs, one solution is the development of alternative identities. This is sometimes risky (remembering the status quo), but can be liberating for the individual and change inducing for the environment. In women's narratives, this was the most common thread: the search for how I can be a good engineer and at the same time, a woman with whom I am comfortable. Within this tension, femininity is also redefined and reconstructed constantly.

“Being different” from the majority or legitimated others is challenging to both the individuals and the society, because both react to this situation. This research reports how women cope with “being different” in engineering. Engineering women's ways of being different are significant not only for those struggling with identities in other contexts, but also for those developing the policy for better educational environment. Understanding women's situation and its uniqueness helps to bring a general view about developing a more welcoming learning climate, one which does not exclude individuals who do not fit it well. Such a climate would encourage mentoring or support programs, but would also be directed at those who are used to supporting the status quo. A welcoming community is one that contains both the welcomed and the welcomers. Also, the research suggests that the field of engineering must emphasize the importance of flexibility that includes both flexibility of the subject matter but also flexibility of the practitioners.

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APPENDIX A

RECRUITMENT EMAIL FOR FOCUS GROUPS

Dear Female Students in Engineering Departments at Texas A&M University:

I am writing to you ask for your participation for the study, **Professional Identity Construction of Women in Engineering: Focus Group Meeting**. This study is supported by the Texas A&M Women's Studies Program and the Social Psychology Laboratory in the department of Sociology. This is a study of the women's experiences and lives in Engineering education programs. The researcher will ask a few questions about whether you feel that you were adequately prepared for the engineering program and if you have suggestions that might help future students. Those attending the sessions are free to respond or not respond to any questions. Additionally, you are encouraged to bring up issues they believe to be important.

You will simply meet with a few other students and discuss your experiences. The group will meet for an hour and a half to two hours at a time convenient for all members. The meeting will take place at ACAD #307 and discussion will be videotaped.

While a final report will be made available to the engineering department, no names will be associated with particular comments.

This study has been reviewed and approved by the Institutional Review Board Human Subjects Research, Texas A&M University. For research related problems or questions regard subjects' rights, I can contact the Institutional Review Board through Dr. Michael Buckley, Director of Support Services, Office of the Vice President for Research at 979-458-4067 or mwbuckley@tamu.edu

You will be paid \$15.00 for your participation. To take part in the study, please contact Iris Park Chu to make an appointment. You may either call (845-6736) or

email (irisparkchu@neo.tamu.edu). If you need any help or have questions, please contact Dr. Jane Sell (j-sell@neo.tamu.edu or 845-9314).

Sincerely,

Jane Sell, Graduate Advisor, Dept. of Sociology

Iris Hye-Jin Park Chu, Principal Investigator

APPENDIX B**INFORMED CONSENT FOR FOCUS GROUPS**

1. I understand the purpose of this study is to investigate the experiences women have in learning environment, Engineering education programs.

2. I understand that this study concerns the experiences and lives of female students in engineering school. I understand that:

a. this study is conducted during the fall semester of 2003 and spring of 2004;
b. the participants are up to 10 people which are divided into two groups; and
c. the discussion of focus group will be videotaped and coded by the principal investigator and research assistants.

d. the participants introduce themselves each other before the discussion, but the introductions will not be videotaped.

e. the consent form, the recorded video tape and coded data will be stored in secured place, Social Psychology Laboratory at TAMU for 5 years.

3. I understand that I will receive \$15 if I participate in the entire group session and my SS# will be collected when I get paid. I understand my SS# will not be connected to the research data.

My participation is voluntary and I can choose to respond or not respond to particular issues raised during the focus group session.

I also understand that I am free to leave the group at any time. However if I leave before the end of the session, I will receive \$5 rather than \$15

4. I understand that what I say during the discussion is completely confidential and will be released only as summaries in which no private information can be identified on the final report. I understand that no one other than the principle investigator, graduate committee members and research assistants will have access to data from the discussion and that after focus group discussion data has been entered into an electronic database, the researcher will destroy any identifying information. I understand that the recorded tapes of discussion, data files, and paper documents will be protected at all times in secured space.

5. I understand that this study has been reviewed and approved by the Institutional Review Board Human Subjects Research, Texas A&M University. For research related problems or questions regard subjects' rights, I can contact the Institutional Review Board through Dr. Michael Buckley, Director of Support Services, Office of the Vice President for Research at 979-458-4067 or mw Buckley@tam.u.edu

6. If I have any questions, I understand that I can contact the principle researcher for this study as follows:

Dr. Jane A. Sell,
 Graduate Advisor
 Department of Sociology
 By email: j-sell@neo.tamu.edu
 By phone: 845-9314

Iris Hye-jin Park Chu,
 Graduate Student and Principal Investigator
 By email: irisparkchu@neo.tamu.edu
 By phone: 845-6736

Participant Name:

Date:

Investigator: Iris Hye-Jin Park Chu

Date:

2 of 2 _____(initials) _____(Date)

APPENDIX C

FOCUS GROUP DISCUSSION QUESTIONS

The principal researcher will prepare the discussion questions-open ended questions and topics upon experiences and lives of female students in engineering programs for the focus group meeting. The principal investigator will encourage participants to address relevant issues and add questions during the discussion at the meeting.

A. Starting the Meeting

Why don't we introduce ourselves to each other?

We introduce ourselves each other to get a casual and comfortable discussion. However, the introductions are not going to be taped.

Can you tell us what year you are; what you major; and if you are a member of female engineering students' association, how long and why you are involved in it?

B. Discussion of Women's Lives and Experiences in Engineering School

What aspect of your major do you like most?

What supports are there for you in your program? What obstacles?

What factors had a major influence on your decision to choose your current major?

Have you ever seriously considered quitting or transferring out of your major?

Compared to other students in your program, do you think you perform the academic tasks successfully?

Is your program predominantly (white) male setting? How does this affect your experiences in school?

Based on your experience, do you feel the faculty members in your program, overall, are supportive of students?

Based on your experience, do you feel faculty members in your program, overall, have different expectations or assumptions of male and female students?

Have you ever received negative reactions from other colleagues or teachers when you ask questions in any academic activities?

Have you ever felt uncomfortable while you work with other students in your program?

How about the relationship with your academic advisor? What gender is your current academic advisor? Who generally initiates communication between you and your academic advisor?

What activities, any kind of activities do you participate in?

Some people describe women as minority in engineering fields and women often feel excluded from men or “majority.” Considering this statement, what does it mean to be a woman in engineering school?

What do you cherish about being a woman in engineering programs?

Are there any things about being a woman in engineering programs that bother you?

Do you perceive any constraints in the success for being a professional engineer that grounded in issues of gender or other aspects of yourself? How are you confronting such constraints?

C. Closing the Meeting

How have you been feeling about the many things we talked about today?

Anything you feel you’d like to restate or re-discuss?

APPENDIX D

INFORMED CONSENT FOR SURVEY

Educational Experiences of Engineering Students

I have been asked to answer some questions that concern the experiences of engineering students at Texas A&M. This research study is being conducted during the fall semester of 2004 and involves about 100 individuals in different engineering classes. The questionnaire will take from 7 to 10 minutes to answer.

I understand this study is anonymous and so my name will never be associated with the questionnaire or any answers. All results are released only in summaries so no one will know what specific answers I provide. Only members of the research team will have access to the individual questionnaires. I understand that I do not have to answer any questions that make me feel uncomfortable. My participation is completely voluntary and I understand I am free to withdraw the study whenever I want.

I understand the risks associated with this study are minimal and there is no benefit of participation. I also understand this study is not associated with any class at Texas A&M University and no class credit is involved and that my participation in this study will not affect my grades now or in any future classes at Texas A&M University. There is no monetary reward for my participation. However, if I wish, I can volunteer to sign up for a follow up study which pays \$10 for my participation.

I understand that this study has been reviewed and approved by the Institutional Review Board Human Subjects Research, Texas A&M University. For research related problems or questions regarding subjects' rights, I can contact the Institutional Review Board through Dr. Michael Buckley, Director of Research Compliance, Office of the Vice President for Research at 979-845-8585 or mw Buckley@tamU.edu.

I have read the above information. I have asked any questions and received answers to my satisfaction. I have been given a copy of this consent document and I voluntarily agree to participate.

If I have any questions, I understand that I can contact the principle researcher for this study as follows:

Dr. Jane A. Sell, Graduate Advisor

Department of Sociology

By email: j-sell@neo.tamu.edu

By phone: 845-6120

Iris Hye-jin Park Chu, Graduate Student and Principal Investigator

By email: irisparkchu@neo.tamu.edu

By phone: 845-6264

Participant's Written Name: _____ Date: _____

Participant's Signature: _____

Investigator's Signature: _____ Date: _____

APPENDIX E

QUESTIONNAIRES OF SURVEY

The purpose of this questionnaire is to assess student experiences in engineering school at Texas A&M. To protect your privacy, the survey is anonymous, so please do not put your name anywhere on the questionnaire. Please respond to the following questions based on your OVERALL experiences in engineering school by checking the box that applies. Omit any questions that do not apply to you.

(Demographic questions here)---

1. I am:

- (1) a freshman sophomore junior senior or graduate ;
 (2) female or male ;
 (3) white black Hispanic Asian Native American or others .

2. What is your academic department?

My academic department (my major) is _____.

* Below are a set of statements. Please check the box that best represents your agreement or disagreement with the statements about your overall experience in engineering school:

3. Based on my overall experience in engineering school, I **enjoy** the courses associated with your major:

- 1) not at all 2) just a little 3) somewhat 4) fairly more 5) very much .

4. Based on my overall experience in engineering school, I am **satisfied** with the quality of **teaching** in my engineering program:

- 1) not at all 2) just a little 3) somewhat 4) fairly more 5) very much .

5. Based on my overall experience in engineering school, I am **satisfied** with the **relationship** with the faculty members in my engineering program:

- 1) not at all 2) just a little 3) somewhat 4) fairly more 5) very much .

6. Have you experienced any difficulties in surviving the engineering programs?

- Yes --- if yes, please go to #7.
 No ---if no, please go to #8.

7. Based on my overall experience in engineering school, I have experienced difficulties in surviving engineering curriculum:

- 1) not at all 2) just once 3) sometimes 4) very often 5) always .

7-1. If you had ever experienced difficulties in surviving engineering programs, what kinds of factors contribute to feel the difficulties? (You can mark more than one item.)

- 1) poor quality of teaching []
- 2) poor relationship with faculty members []
- 3) poor relationship with other students []
- 4) lack of financial support []
- 5) dissatisfaction with grades []
- 6) dissatisfaction with workload and speed of progress []
- 7) competition with other students []
- 8) lack of support from faculties []
- 9) others, please specify: _____

8. I am generally pleased with my entire education at Texas A&M University.

- 1) not at all [] 2) just a little [] 3) somewhat [] 4) fairly more [] 5) very much [].

9. Based on my overall experience in engineering school, I have thought change or leave my engineering program

- 1) not at all [] 2) just once [] 3) sometimes [] 4) very often [] 5) always [].

10. Most professors in engineering programs care about their students.

- 1) not at all [] 2) just a little [] 3) somewhat [] 4) fairly more [] 5) very much [].

11. Most professors outside of engineering programs care about their students.

- 1) not at all [] 2) just a little [] 3) somewhat [] 4) fairly more [] 5) very much [].

* People use different terms to describe engineers. Check the box associated with the terms you think best describe engineers. (you can check up to 3):

12. Based on my overall experience in engineering school, I think the word which demonstrates the image of an engineer very well should be:

- 1) diligent [] 2) busy [] 3) patient [] 4) functional [] 5) punctual []
 6) studious [] 7) geek [] 8) nerd [] 9) reliable [] 10) neutral [] 11) hard-
 worker [] 12) hacker [] 13) masculine [] 14) feminine [] 15) challenging [].

*Some researchers believe that almost all terms can be evaluated in three dimensions--evaluation (good/bad), potency (power/powerless) and activity (active/inactive). For instance, someone will be asked to express his/her emotional EPA toward certain objects--man, woman, political scientists, teachers, flight attendants, scientists, etc. or for certain actions—fighting, helping, cleaning, etc. So, for example, someone may indicate his/her feelings about a “baby” as:

Bad/awful ___ ___ ___ ___ ___ ___ ___ ___ X Good/nice
 Powerless/little ___ X ___ ___ ___ ___ ___ ___ Powerful/big/fast
 Quiet/inactive ___ ___ ___ ___ ___ ___ X ___ Noisy/active

This would mean that the person above thought about “baby” as very good, not very powerful, and relatively noisy or active.

Please indicate your emotional EPA toward these following items:

13. Object: Man

Bad/awful ___ ___ ___ ___ ___ ___ ___ ___ Good/nice
 Powerless/little ___ ___ ___ ___ ___ ___ ___ ___ Powerful/big/fast
 Quiet/inactive ___ ___ ___ ___ ___ ___ ___ ___ Noisy/active

14. Object: Engineer

Bad/awful ___ ___ ___ ___ ___ ___ ___ ___ Good/nice
 Powerless/little ___ ___ ___ ___ ___ ___ ___ ___ Powerful/big/fast
 Quiet/inactive ___ ___ ___ ___ ___ ___ ___ ___ Noisy/active

15. Object: Kindergarten Teacher

Bad/awful ___ ___ ___ ___ ___ ___ ___ ___ Good/nice
 Powerless/little ___ ___ ___ ___ ___ ___ ___ ___ Powerful/big/fast
 Quiet/inactive ___ ___ ___ ___ ___ ___ ___ ___ Noisy/active

16. Object: Nurse

Bad/awful ___ ___ ___ ___ ___ ___ ___ ___ Good/nice
 Powerless/little ___ ___ ___ ___ ___ ___ ___ ___ Powerful/big/fast
 Quiet/inactive ___ ___ ___ ___ ___ ___ ___ ___ Noisy/active

Additional comments or questions?

If you want to participate in PAID further studies, please fill out the contact form and turn it in to the investigator now.

Thank you for your time.

APPENDIX F**CONTACT INFORMATION FORM FOR PAID FURTHER STUDIES**

If you want to participate in paid further studies,

“Being a Female Engineer: Identity Construction and Resistance of Women in Engineering Schools,”

please fill out the following contact information.

Name: _____

Major: _____

Phone Number: _____

Email address: _____

Please detach this form from the survey and turn it in to the investigator.
Thank you much.

APPENDIX G**RECRUITMENT EMAIL FOR AUTOBIOGRAPHY**

Hi,

I am Iris H. Park Chu who surveyed your engineering class (or association meeting) during the last Fall semester.

You may remember you signed up for follow-up studies when you answered my survey in the classroom.

My next project is to hear stories from engineering students, and it is a PAID study.

I will ask you to write a short essay about yourself and this essay will be focused on your experiences that are relevant to engineering and engineering school.

If you want to participate in this project, please let me know. I will send more information about it to you.

Most importantly, this study is confidential and so your name will never appear on the report of this study. All results are released only in summaries so no one will know what specific stories and cases you provide.

The payment for writing an essay will be \$25.00.

I am looking forward to hearing from you soon.

Thank you for your time and concern.

Iris.

p.s. Even though you can not participate in this project, could you reply to this letter? That helps me to organize the participant list. Thank you.

APPENDIX H**EMAIL FOR THE AUTOBIOGRAPHY PARTICIPANTS 1**

Thank you for your reply and participation!!

Before I confirm and schedule the study, please let me have some basic information about you. This information helps me to categorize participants for analyzing the data.

Please inform me about:

- (1) Your classification (Freshman ~ Graduate) []
- (2) Sex []
- (3) Race []
- (4) Age []
- (5) Academic Department/Specific Major []
- (6) Contact Information (Phone number) []

Thank you for your concern and participation again, and I will send you the instruction for writing an essay and the informed consent form soon.

Iris.

APPENDIX I**EMAIL FOR THE AUTOBIOGRAPHY PARTICIPANTS 2**

Hi,

Thank you for your participation again!

I attached the instruction page and the informed consent form with this email.

Please read it for writing your essay, and if you have any question about it, please feel free to contact me.

When you need to turn in your essay, please let me know.

I expect that you will type it and send it to me via email.

We may need to meet because I should pay you (it's a cash award) and receive your signed informed consent form.

Thank you and GOOD LUCK!!

Iris.

APPENDIX J

INSTRUCTION FOR AUTOBIOGRAPHY

Thank you for your participation again!

The purpose of this project-writing a short essay about self (autobiography) is to explore how engineering students think of themselves as engineers.

This essay is not related with your grade and no one in your department or field will know anything about what you write on the essay.

So, you can write what you want to say about your experiences, feelings, and thoughts about engineering school, engineering program and becoming an engineer. You can organize this however you wish, but it is probably best to pick three or four times to think about your program and how you are or are not changed by your experiences. You might think about answering the questions: How have I become an engineer?; What shaped that decision?; How have I been surprised (or not surprised)?; How do I think others see me (in the engineering society)?

There is no length limitation for this essay but I do not expect you to write a book.

Several pages are just fine.

I also anticipate receiving your essay around MID MARCH. I understand that you are one of the busiest engineering students in the world, so I can wait until the end of the SPRING BREAK (Sunday, March 20, 2005.) However, if you need more time to write it up, please let me know.

When you need to turn in your essay, please contact me. We may need to meet because I should pay you (it's a cash award) and receive your signed informed consent form.

If you have questions while you write the essay, please feel free to contact me.

Thank you.

Iris.

APPENDIX K**INFORMED CONSENT FOR AUTOBIOGRAPHY**

1. I agree to write my autobiography that concerns the experiences of engineering programs at Texas A&M. This study is being conducted during the spring semester of 2005 and involves about 30 individuals in different engineering programs.

2. I understand this study is confidential and so my name will never appear on the report of this study. All results are released only in summaries so no one will know what specific stories and cases I provide. Only members of the research team will have access to my autobiography.

I understand that I do not have to write any thing that makes me feel uncomfortable.

3. I understand the risks associated with this study are minimal and this study is not associated with any class at Texas A&M University. I understand that no class credit is involved and that my participation in this study will not affect my grades now or in any future classes at Texas A&M University.

The benefit of participation is that I will receive \$25.00 if I write my autobiography. My SS# will be collected when I get paid. I understand my SS# will not be connected to the research data.

My participation is voluntary and I can choose to write or not write to particular issues raised during I write my autobiography.

4. I understand I am free to withdraw this study at any time. However if I stop writing my autobiography before I complete it, I will receive \$5.00 rather than \$25.00.

5. I have read the above information. I have asked any questions and received answers to my satisfaction. I have been given a copy of this consent document and I voluntarily agree to participate.

1 of 2 _____(initials) _____(Date)

6. I understand that this study has been reviewed and approved by the Institutional Review Board Human Subjects Research, Texas A&M University. For research related problems or questions regard subjects' rights, I can contact the Institutional Review Board through Dr. Michael Buckley, Director of Support Services, Office of the Vice President for Research at 979-458-4067 or mwmbuckley@tamu.edu

If I have any questions, I understand that I can contact the principle researcher for this study as follows:

Dr. Jane A. Sell,
 Graduate Advisor
 Department of Sociology
 By email: j-sell@neo.tamu.edu
 By phone: 845-6120

Iris Hye-jin Park Chu,
 Graduate Student and Principal Investigator
 By email: irisparkchu@neo.tamu.edu
 By phone: 845-6120, 845-6264

Participant Name:

Date:

Investigator: Iris Hye-Jin Park Chu

Date:

APPENDIX L**RECRUITMENT SCRIPT FOR INTERVIEW**

Hi,

My next project is to hear stories from engineering students, and it is another PAID study.

This is one-on-one interview format and the interview will focus on your experiences that are relevant to engineering and engineering school.

It usually takes one or one and a half hour and the payment for the interview will be \$25.00.

Most importantly, this study is confidential and so your name will never appear on the report of this study. All results are released only in summaries so no one will know what specific stories and cases you provide.

I am looking forward to hearing from you soon.

Thank you for your interest in this project, again.

APPENDIX M

QUESTIONNAIRES FOR IN-DEPTH INTERVIEWS

1. Introduction

2. Decision

When do you remember first *deciding to become an engineering major*?

How did you decide to become an engineer?

What do you think shaped that decision? (Family, teacher, others?)

What is the most attractive thing about engineering?

3. Successful Engineer is

What do you want to be after graduating college; *what does it look like*?

What is your image of *successful engineer*?

What a successful engineer you want to be?

What should be the strongest predictor or whether or not someone is a successful engineer?

What is your image of successful female engineer?

4. Experiences in Engineering School

4-1) Engineering School, an Unique Place

Some students say engineering school is different from other colleges such like Liberal Arts or Education. What do you think makes engineering different or unique?

In my survey there were various words which might identify engineering best. Do you remember what did you pick? (*Image of engineers*)

Norms and expectations for engineering students: what is the essence of the engineering or “*engineeringness*?”

How do you know engineering is *the field for you*?

What makes you feel or *identify yourself* as an engineer?

Do you ever feel you are *different from* other engineering students or engineers?

4-2) Your experiences

Talk about your experiences in engineering school. Let's talk about your experiences in engineering school. Everything has *pros and cons*, what is the good part for you in engineering? What is bad about engineering?

You can talk about your experiences with professors and colleagues (*dating, team projects, study partners, competition...*). Ever tried *to prove yourself* able or qualified? Weed-out courses, toughest times, negative doubts...according to my survey, women are more likely to consider to *leaving engineering* programs than men. What do you think of this? (But it is *not significant for women of color*. Why?)

4-3) As a Woman Engineer

Are there some aspects of engineering school that you don't like or that you find *difficult*?

No

Yes...if yes, what aspects are there? Can you give me some examples or situations?

Is there any *advantage of being a man* in engineering?

There are many *fewer women* than men in engineering programs. Why do you think that is the case?

Femininity vs. engineering

In my focus group meeting, a woman engineering student said she thought about the way in which she dressed. She said she intentionally wore jeans and shirts so that she would not "stand out" in school. Have you ever thought about what you wear and *what others think of you*? What would you say to her? (Do others expect you to be a girl/ do others see you a girl/do others expect you to behave feminine? Is being a girl more salient?)

Do you ever participate in any association or organization for female engineering students?

Yes...what was the motivation?

No...why?

4-4) Survival Secrets

As a person who has experienced engineering school, what would you say to your (future) juniors? What is your *advice (in terms of personality...)* for future engineering students to be successful engineer? What is your *secret to survive* in engineering school?

**Did engineering change you a lot?*

VITA

Hyejin Chu
 406-2003 Hyundai Apt
 Okryun, Yunsu, Incheon
 South Korea 406-772

Department of Sociology
 Texas A&M University, MS 4351
 College Station, Texas 77843-4351

EDUCATION

Texas A&M University	Sociology	Ph.D.	2006
Seoul National University, South Korea	Sociology	M.A.	1999
University of Incheon, South Korea	Education of National Ethics & Social Sciences		
		B.A.	1996

PUBLICATIONS AND CONFERENCE PRESENTATION

- 2006 “Social Constructionism” and “Social Identification” The International Encyclopedia of the Social Sciences 2nd edition Macmillan Reference USA / Thomson Gale, 2007
- 2005 Iris Hyejin Park Chu. “Toward Being a Female Engineer: Women’s Experience in a Male-Dominated Field.” Presented at the 2005 American Sociological Association Meeting, at the Session of Organizations, Occupations, and Work Roundtables in Philadelphia, PA.
- 1999 Masters Thesis: “The Characteristics of Liberty Song Movement of Korea in 1945”

AWARDS AND GRANTS

- 2005 Graduate Student Travel Grant Award, Women’s Studies Program, Texas A&M University
- 2003~2004 Graduate Research Grant, The Melbern G. Glasscock Center for Humanities Research, Texas A&M University.
- 2003~2004 Dissertation Research Grant Award, Women’s Studies Program, Texas A&M University.