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WOMEN IN ENGINEERING: IDENTITY COMMUNICATION IN SOCIAL MEDIA

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WOMEN IN ENGINEERING: IDENTITY COMMUNICATION IN SOCIAL MEDIA

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ABSTRACT

This thesis examines women engineers' experience in social media with a focus on identity communication. Framing as a case study, this study attempts to explore women engineers' online presence and how they utilize social media in their daily activities. Using the concept of intersectionality, this study addresses the differences of social media usage among women engineers in terms of the use of social media by professional organizations of women engineers and the use of individual women engineers. Thematic analysis was conducted to analyze the public available data from a Facebook page maintain by a well-known women engineers' professional organization. Online survey was also conducted in order to capture individuals' perceptions of using social media. Findings show, first, similar trends of using social media can be found among women engineers as the most popular social media accounts owned by women engineers are Facebook, LinkedIn and Twitter. Second, women engineers use social media mostly for information exchanging and maintaining pre-existing relationships with friends and family. Third, women engineers considered social media to be not effective platforms for professional communication and privacy issues are the major concerns of adopting social media. In summary, this study offers insights on women engineers' online presence and suggests more effort is required in building online professional support networks for women engineers.

DEDICATION

This thesis is dedicated to my parents and grandparents for their unconditional love and support, and to all the people who always believe in themselves and pursue their dreams.

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CHAPTER ONE

INTRODUCTION

It was another ordinary day for me – sitting in the communication studies lab, waiting for students to come in and practice their speeches. But today was different – a young white male student came in and looked at me, before I even had a chance to introduce myself like I usually do, he asked, "Are you good at this?" I was confused with the question so I looked back to him and waited for him to clarify the questions. "I just want to make sure that I am in good hands," he added, and sat down in a very relaxed pose to wait for my answer. "My name is Dongni, I am one of the lab instructors of COMM 150, and I will be critiquing your speech today," Meanwhile, I pulled out the rubric binder and straightened my back so that I looked more professional. The rest of the critique session went fairly well and I believe the student left with satisfaction. However, after this little "incident," I could not help but wondering what made the student ask me if I am good at what I am doing. Is it because I look like a student which leaves me no credentials as a tutor, or is it because I am Chinese but somehow I am critiquing an American student's speech? I am sure the student may not be doing this on purpose, and he probably did not even realize why he asked the question, but this little incident certainly added into the minor aggression as I am a member of a minority group in this society.

Born and raised in Guangzhou, the third largest city in China, I spent the first 20 years of my life without having to worry about not fitting in. However, ever since I started to study abroad in the United States in 2007, I realized things in the U.S. are

different, people talk differently, people think about things differently, and people act differently. There are certainly a lot of changes that I have had to adapt to. People I know in the U.S. often ask me why I picked Clemson University for graduate school as if I was not a natural fit for this particular university, which is usually well known for its engineering programs and its history as a military college and happen to be located in a small town in the south. For me, the opportunity to be a teaching assistant is what drew me to Clemson. The first woman faculty member of Clemson University was appointed 1918 (Reel & Bennett, 2006). Almost a hundred years later, there are a total of 387 full time women faculty members, and 72 part time and temporary women faculty members among its 1370 faculty (Clemson University Office of Institutional Research, 2012). In other words, only one-third of faculty members are women which further implies that being a woman instructor at Clemson could therefore be considered being a minority.

Now this is the sixth year that I am staying in the U.S., being a minority, a non-native English speaker and a woman who living in a White male dominated English-speaking country, I have still frequently encountered a dilemma where I am trying to maintain my own cultural identity, yet at the same time I am also trying to blend in with the local social culture. The process of perceiving my own identity through interactions between myself and others, struggling to maintain my own identity in a different culture, allows me to relate to women in engineering, who are consistently experiencing the same process of identity negotiation in a male-dominated profession. To be women who work in the profession of engineering or to be engineers who are women are clearly two concepts. These two concepts are constantly competing with one another while these

women are perceiving their unique identity. These women were often asked directly or indirectly to demonstrate their professionalism at work just because they are women, who do not seem to fit in the profession of engineering. Very often women in engineering have to choose their identity either based on their gender identity or professional identity. Because of the masculine characteristics that have long characterized the development of the culture of engineering, some women are searching for belonging when they try to be more *manly* at work, and some women are learning to negotiate and bring in their feminine characteristics as advantages. In my opinion, the journey of developing a unique identity in a different culture is like bringing a different flavor to the table. Maybe there is a better way to situate the self in different culture instead of choosing sides.

While pursuing my degree in Communication, Technology, and Society, I had encountered a chance to work closely with a group of female engineering students in a national mentoring program for several months. Thanks to Facebook, I was able to maintain the friendships with these girls after the program. Then, this unique opportunity made me think of women engineers' relationship with technology, especially their use of social media. Personally, I have to admit that social media (e.g., Facebook, Twitter, LinkedIn, etc.) helped me know more about the culture of the United States and provided help in situating myself in a different culture. Moreover, using social media also allows me to stay in touch with my family and friends in China. Although some of the social media sites (e.g. Facebook, Twitter, YouTube, etc.) are not available to access in China, many local Chinese social media sites (Sina Weibo, WeChat, Renren, etc.) are able to provide similar communication avenues that benefit me and my family and friends who

are far apart geographically. Ever since social media gained worldwide popularity over the past decade, countless studies were conducted to understand the impact of social media on communication. The popularity of social media has certainly affected many aspects of our social life. However, what about women engineers and their use of social media?

Women have been long reported to have less representation than men in the field of engineering. What are women engineers' perceptions about their situation in the field of engineering? Do they agree that they do not belong in engineering because they are not males? Do they feel like their lack of support from family, peers and society could have been preventing them from staying in the profession? Moreover, how are they negotiating their identities in everyday life?

There may not have been enough changes happening for women in engineering over the past twenty years, however, one thing – the internet – has undoubtedly changed and affected communication. Over the past five years, when it comes to providing instant information exchange, networking opportunities and social support, social media has become a popular platform of accomplishing these needs. In addition, using social media provides a means to manage long-term relational maintenance that helps to overcome the obstacles such as time and distance. However, using social media as an alternative platform to communicate issues that women in engineering are facing in everyday life is rarely explored by scholars and institution officials. Previous studies either mainly look at women who are studying engineering in college, or look at women engineers who are already practicing engineering as their profession, little has been done to bridge these two

groups' experience together. Others have mainly focused on individual identity management but little has been done towards collective identity building or community construction. Therefore, the examination of their presence in social media could potentially provide a more comprehensive understanding of these women's experience since what they have been contributing online are largely remain in a natural setting. In addition, while one of the possibilities of social media is a platform for identity communication, the potential and challenge of women engineers' presence on social media has not yet been fully explored.

Nevertheless, being a woman and also a young researcher, my own experience has certainly influenced my disposition as an investigator on this topic. However, this should not hinder my ability to relate to women engineers' experience but rather enrich the understanding of it.

As a result, the main goal of the current study is to explore women engineers' presence and activities in social media. In addition, the study aims to provide an understanding of women engineers' experience from a more authentic way. Using an interpretive, feminist approach and the concept of intersetionality, this qualitative study will be framed as a case study. Both thematic analysis and online survey questionnaire approaches will be applied to support the interpretation and analysis of the phenomenon.

The following questions will guide the study:

RQ1: Which social media are women engineers using?

RQ2: How do women engineers use social media?

RQ2a: Are women engineers using social media for social support?

RQ2b: Are women engineers using social media for identity communication?

RQ3: What are women engineers' perceptions of using social media?

CHAPTER TWO

LITERATURE REVIEW

This section provides a review of literature on women engineers and social media. First, a general understanding of engineering culture, the current situation of women in engineering, and the strategies of confronting the ambivalence of being women engineers are provided. Then a brief overview of social media, social networking sites, Facebook, the opportunities and challenge of using social media are detailed. Finally, the theoretical perspective of intersectionality and application are presented.

Culture of Engineering

Research on women in engineering can be traced back to the 1970s (McIlwee & Robinson, 1992a). Although the number of women in engineering has grown in the past thirty years, it is still a mystery why there are not as many women as men working in engineering. According to a report published in 2010 by American Association of University Women (AAUW), women earned only 20 percent of bachelor's degrees in fields such as physics, engineering, and computer science compared to their male colleges (Hill, Corbett, & St. Rose, 2010). Despite the fact that overall undergraduate enrollments of women were higher than men at all institutions across fields, only 17.9 % of women enrolled in engineering program (National Science Foundation, National Center for Science and Engineering Statistics, 2012). It is estimated that the proportion of engineering degrees awarded to women will remain stable over the next few years based on the current data on undergraduate program enrollment (Yoder, 2011). The small portion of women studying engineering has long been a problem, and the continual

underrepresentation has contributed to the problem that fewer women will stay in the profession after they graduated. Hence, engineering professions are male-dominated and will remain the same for a long time since there are not enough women in this field to make the change.

Researchers are constantly seeking to understand why there are so few women engineers. As Faulkner (2000b) states, the "pleasure in technology" (p. 109) has long been recognized as a central element of the shared culture of engineers as well as a central element in constructing individuals' identities. Moreover, since men have "both the appropriate rationality and good mechanical skills" (p. 145), men are considered to be "more 'natural' technologists. According to Hacker (1981; 1983), the "culture of engineering" centers technology over personal relationships and highly values abstract knowledge over humanistic knowledge which ultimately demonstrates a tendency for masculine in engineering. Therefore, women are often deemed as unfit for the culture of engineering.

In addition, Robinson and Mcllwee (1991) also explain that the culture of engineering reflects the norms and values regarding the "correct engineering practice" (p. 19), which is also defined by male engineers. The notion of "culture of engineering" ties in the day-to-day practices of engineering. It is also maintained by the engineers who have power in the work place, and through the everyday performance and interaction with one another (Robinson & Mcllwee, 1991). Furthermore, Robinson and Mcllwee (1991) argued that the culture of engineering consists three major components, including the centrality of technology and the producer (engineers) of this technology, the

achievement of organizational power as the base of engineering success, and the interest of both technology and power in a well presented form which defined by male gender role.

Besides technology and organizational power, the culture of engineering also values behaviors and orientations that align with male gender roles (McIlwee & Robinson, 1992b). To be more specific, it has been acknowledged that: “Competence as an engineer is a function of how well one presents an image of an aggressive, competitive, technically oriented person” (McIlwee & Robinson, 1992b, p. 20-21). Not surprisingly, gender, a concept rooted so deeply in our societal culture and constantly shaping how we talk and think about each other, is greatly affecting the culture of engineering. Carol Cohn (1993), a well-known scholar who studies gender and security issues, talked about the differences between discourse of men and women using the examples of how defense intellectuals talk to each other in her article, "Wars, Wimps, and Women: Talking Gender and Thinking War". She defines gender as:

> a symbolic system, a central organizing discourse of culture, one that not only shapes how we experience and understand ourselves as men and women, but that also interweaves with other discourses and shapes them – and therefore shapes other aspects of our world. (p. 228)

In other words, this system, gender discourse, is so powerful that it is influencing and shaping our practice of ourselves being men or women, and interaction with others. More importantly, Cohn (1993) pointed out that in gender discourse, men and women are expected to associate with the characteristics that are dichotomized and mutually

exclusive. In addition, she stated that, "to be abstract, logical or dispassionate" is considered to be manly and more highly valued by our society (Cohn, 1993, p. 229). Therefore, the practice of engineering, which associates with certain characteristics that are more closely related to men, is considered to be highly gendered. In the same vein, Louis Bucciarelli (1994) made the following statement in the book titled *Designing Engineers*, "when we look at the contemporary world and see technology, we often oversimplify and split the world in two" (p. 48). Moreover, in arguing the mismatch between symbolic images and discourses of dualisms and the practice of engineering, Wendy Faulkner (2000a) specifically drew attention to the following three aspects:

> First, virtually all the dualistic epistemologies found in engineering practice *coexist in tension*; Second, in most cases the two sides of these dichotomies are not equally valued; Third, many of these dichotomies are gendered – that is to say, they are socially coded 'feminine' and 'masculine' – often in quite contradictory ways (p. 760, emphasis in original).

In the same article, Faulkner (2000a) further detailed three aspects in which engineering can be gendered:

> (1) *gender differences* in divisions of labour and in styles of the work women and men perform; (2) *gendered symbols*, even in the detail of engineering practice; (3) where gender and technology 'meet' in individual engineers' personal and/or professional *identities* (p. 761, emphasis in original).

Therefore, it would be interesting to investigate how culture of engineering is substantially shaping by the social culture – the expectations of what men and women supposed to be behave.

In addition to gender characteristics which have been attached to the culture of engineering, Schiebinger (2001) also indicated that the definition of who are scientists and what science is, are both associated with gender.

Scholars from across disciplines have also contributed their efforts to address the issue of underrepresentation of women in engineering. For instance, studies have been conducted to understand why young women are leaving the profession so early by studying experience of female college students who major in engineering, how media representations affects women in engineering, and how women in engineering negotiate their identity through everyday life. As noted in a report published by the Committee on Maximizing the Potential of Women in Academic Science and Engineering, the cause of underrepresentation of women in engineering is not because of the lack of talent among women but the "unintentional biases and outmoded institutional structures" (Committee on Maximizing the Potential of Women in Academic Science and Engineering, National Academy of Sciences, National Academy of Engineering, Institute of Medicine, 2007). Other causes that have been identified which may contribute to women's underrepresentation in engineering programs include: pre-college preparation, recruitment programs, admissions policies, financial assistance, academic intervention programs, and graduate school preparation and admission (May & Chubin, 2003) .

However, it is still common that women in engineering are experiencing isolation which comes from the feeling of not belonging in a male-dominated profession. When describing their experience, women in engineering regularly mention that they know nobody around them who is in the same situation (Women's Leadership STEM panel). The problem of lack of recognition and support network has been recognized by many of the professional organizations of women engineers. Different kinds of special programs (e.g., Mentoring Programs, Annual Conferences) have been putting together to address this problem. Nevertheless, the longevity of these programs often requires a lot of manpower, time commitment, and financial support.

Women in Engineering

To further address the underrepresentation of women in engineering, researchers often focus on the socialization process as it explains gender differences and status quo in engineering professions. It is has been argued that the gender identity developed during socialization process could have been contributing to the inequality in professions like science, technology, engineering, math (STEM). For instance, according to the U.S. Department of Labor, occupations which comprise 25 percent or less of total employed are considered nontraditional occupations for women. Among these nontraditional occupations, many of them are related to STEM fields, for instance, construction and building inspectors, computer programmers, chemical engineers, aircraft pilots and flight engineers (Women's Bureau of the U.S. Department of Labor, 2010).

Socialization, defined by Seymour (1999), is "a lifelong interactive process in which people learn the values, attitudes, behavioral norms, and roles that are seen as

appropriate for particular groups of people (including those for men and women) in any culture" (p. 118). Moreover, socialization influences how people understand an appropriate choice should be for themselves or for others (Seymour, 1999). For instance, when we were children, we learned that girls are supposed to be nice and clean, and listen to their parents, but boys can play outside and get their hands dirty or even get into fights. During the socialization process, we learn these norms. In other words, we learn to perform only appropriate and expected behaviors which were generally followed by others. Without doubt that gender roles are products of socialization process, and have been encouraging us to think, feel, talk and act based on the perceptions of what others expect of us. According to Seymour (1999), during socialization process, "girls are encouraged to perform for the approval of others and to attach feelings of confidence and self-worth to signs (such as praise) that others are pleased by what they do" (p. 119). Occupations and careers choices are then reflections of such expectations. Similarly, Hubbard (1984) states that women's early socialization experience are unsuited with a cultural climate which demands for both hierarchical work structures and masculine working practices.

Science, mathematics and engineering majors are often largely designed in order to meet the needs of men, and because of this, women have to confront these conflicts in their own socialization experience (Seymour, 1999). Moreover, different socialization experience reflect different socio-cultural expectations for men and women, and affect career choices of men and women which then lead to the lack of women in the field of engineering. In their book *Talking about Leaving: Why Undergraduates Leave the*

Sciences, Seymour and Hewitt (1997) claim that cultural assumptions of gender affects women's choices in choosing or leaving science related majors.

Gender, a highly socialized concept, has been defined as the socialization of sexes, which creates certain differences between men and women (Rolin, 2008). Rolin (2008) points out that: "In gender ideologies regulative rules tell what behaviors are appropriate for women as women and men as men" (p. 113).The notion of "gender is the social meaning of sex" reveals that gender is being practice in everyday life of both men and women and restricts men and women to practice certain behaviors based on the socially constructed rules and expectations. Moreover, gender roles are not only different based on how they are biologically sorted, separated, and socialized in certain contexts, but also based on the inequality between women and men in power and hierarchy. Hacker (1981) also argues that the dualism based on mind/body emphasizes men who are normally presumed to have a strong association with rationality are superior over women who are often considered to share an association with emotion. In Susan Bordo's (2003) book *Unbearable Weight*, using "a cultural approach to the body" (p. 35), Bordo points out that the negatively associated understanding of body in mind/body dualism has greatly influence the perception of women, and hence, femininity. As a projection of body, women is then representing "distraction from knowledge, seduction away from God, capitulation to sexual desire, violence or aggression, failure of will, even death" (Bordo, 2003, p. 5). However, on the contrast, masculinity is associated with mind which is superior. Many scholars belief that the mind/body dualism is one of the ideologies that is

most influential to Western thought. The implication that mind is superior and body is inferior has then fundamentally influenced our perception of gender.

As discussed in the previous section, the culture of engineering is closely related to technology. Therefore, technology is the key to understanding the culture of engineering and the key to practicing engineering. Faulkner (2000a) also acknowledged the importance of exploring the gender-technology relations by seeing engineers as a representation of "the still durable cultural equation between masculinity and technology" (p. 761).

However, women are not always considered sharing a close relationship with technology. The common stereotypical perception is that women are not very interested and capable in the field of technology (Van Zoonen, 1992), but men are encouraged to develop certain characteristics that are associated with technical, mechanical and mathematical oriented through families, schools, and other institutions (Robinson & Mcllwee, 1991). Moreover, engineering is perceived to be a "thing oriented" profession while women are in favor of people oriented work (Robinson & Mcllwee, 1991, p. 12). The strong connection shared between technical work and masculinity has created a dilemma for women who are practicing engineering in which they often experience the ambivalence.

In the book which maps out the historical process of how technology and engineering became male exclusive, and how gender relations are affected by technological change, Ruth Oldenziel (1999) indicates that, "men's attraction to technology was, and still is, considered a matter of fact that needs no further explanation",

while in the case of women, whenever they enter the field of engineering or technology, "they need to be accounted for and explained" (p. 9). More importantly, she points out that in fact "there is nothing inherently or naturally masculine about technology" (p. 10) but only after the rise of industrial capitalism when the profession of engineering was being transformed from an elite profession to a mass occupation and engineers – "the exclusive bearers" of technology intended to protect their status that technology and use of the term "technology" has then become male exclusive (Oldenziel, 1999).

Nevertheless, it is important to keep in mind that there are many different types of engineering, for instance, the traditional engineering disciplines include mechanical, civil, electrical, chemical and aeronautical engineering (Frankel, 2008). Whereas, software or computer engineering are often considered not the conventional ways of engineering (Faulkner, 2000a). Faulkner (2000a) also shed some lights in the understanding of culture of engineering where she mentioned differences may exist among different groups of engineers in terms of their working context, their approaches to problem solving, and their shaping of shared cultures. Furthermore, she argued that: "the tendency to dualize, the juxtapositions of dichotomous styles, and the reasons for these patterns, are in broad terms common to all engineers, including software developers" (p. 761). I agree with her assertion and want to point out here that in this study, I aim to look at women in engineering in a broader context.

Being Women Engineers – Confronting the Ambivalence

In order to thoroughly investigate the situation of women in engineering, it is necessary to consider how masculine socio-culture affects women engineers individually.

These women have been culturally marginalized in their everyday practices of engineering. The exploration of how individuals construct their identities and how they confront the process of being marginalized can offer an insight on the existing strategies that women engineers adopt to confront the ambivalence. Identity forms in our social life and is an ongoing dynamic process which emerges through our interaction with others (Hatmaker, 2012; Tate & Linn, 2005). Identity can be shaped or transformed based on one's experience in his or her social roles (Tate & Linn, 2005). For instance, people may perceive various meaning of who they are based on their cultural background, race, ethnicity, religion, socioeconomic status, gender, and age, etc.. More importantly, these identities can be experience simultaneously (Tate & Linn, 2005). In other words, in order to understand how women in engineering react to certain situations has to account for how these women's identities construct their identities based on their own experience.

Being able to negotiate the isolation and ambivalent feelings which women engineers confront in their everyday practice of engineering would eventually allow more women to resist to the male-dominated culture of engineering. Previous studies from different disciplines have identified resources, outlets and strategies which can be utilized in helping women to confront the conflicts.

Negotiating Identity

As acknowledged in previous discussion, identity construction is largely situated in social interaction with others. One's identity is constituted by multiple characteristics which reflect one's sexuality, gender, class, ethnicity, nationality, disability, religion, profession and other characters one has developed during their life experience. These

different aspects of self interact with one another and contribute to one's understanding of self and one's position in society. An individual's identity is continually changing and being shaped by the experience they obtained. Certain parts of our identity maybe innate and can influence who we are but it is no longer the absolute and solely definition of our identity because we can choose to response to that or *not* response to that. For instance, with my study abroad experience in the U. S., I have established my own interpretation of who I am, and found my own way to react to certain aspect of my identity under different circumstances. Many factors, including social expectations of social roles, social norms, and socio-culture backgrounds, all intersect to affect the process of how individuals are constructing their identities. Nevertheless, confronting the ambivalence is never an easy undertaking. However, it is argued that individuals have the ability to react to the situation. West and Zimmerman (1987) state that gender identity is constructed in everyday interactions, performances and encounters with others. Individuals are continually "doing gender", because gender identity is a cultural and structural feature, and an individually possess quality which is perpetually and repetitively produced (West & Zimmerman, 1987). The classic concept of "doing gender" which developed by Candace West and Don Zimmerman (1987) has provided a critical lens through which to look at the dynamic process of identity negotiation of women in engineering. According to West and Zimmerman (1987), "doing gender involves a complex of socially guided perceptual, interactional, and micropolitical activities that cast particular pursuits as expressions of masculine and feminine 'natures'" (p. 126). Furthermore, they explained that "doing gender" is defined as the process of creating *not natural, essential, or*

biological differences among girls and boys and women and men (p. 137). The most famous example of understanding the concept of "doing gender" perhaps would be the creation of public restrooms. In addition, when we "naturally" consent that little boys should wear blue and little girls should wear pink, we are in fact "doing gender". Identity is not born in certain way but continually constructed through the everyday practice of individuals. The notion of "doing gender" granted a possibility that one can choose to perform certain behaviors according to certain cultural norms or expectations, or one can choose to *not* perform certain behaviors so that one can meet certain cultural norms or expectations. In other words, women in engineering have the ability negotiate their own identities in terms of their own situation.

Achieving a Sense of Belonging

It is commonly acknowledged that, being a women engineer, the feelings of isolation, marginalization and inferiority are normal as she may often experience alienation and disconnect with the masculine engineering culture. These feelings negatively affect women's performance in a male-dominated field where women often experience low self-confidence, and question why they are there and what they are doing if they cannot find belonging in a male-dominated field (Etzkowitz, Kemelgor, & Uzzi, 2000). Furthermore, Hatmaker (2012) argues that how to achieve a sense of belonging is a key to understanding the situation of women in engineering. The acceptance into one majority group could have depended on how one's identity is perceived to satisfy certain cultural norms, which means, while constructing their identities; women engineers try to become an insider and gain a sense of belonging among their colleagues (Hatmaker,

2012). Likewise, Dryburgh (1999) reported that women engineers work hard in order to show their solidarity with their male colleagues and coworkers during the professionalization process in engineering. Similar arguments can be found in a study which shows that students in engineering community must learn and make identity "compatible with the engineering" to become an effective member of this community (Stonyer, 2002). The not belonging or not being the right fit to the engineering profession has put women into an inferior or disadvantageous position.

Moreover, Wyer (2003) mentions four different levels of barriers women are facing in science and engineering which includes system barriers, institutional barriers, interpersonal barriers and self-barriers. Similarly, Schiebinger (2001) also points out that changes need to occur in many different areas, such as "conceptions of knowledge and research priorities, domestic relations, attitudes in schools, university structures, classroom practices, the relationship between home life and the professions, and the relationships between different nations and cultures" (p. 1174).

Building Social Support Network

Building a supportive community has been encouraged among many education institutions to help women confront the ambivalence while they are studying engineering. For instance, it is suggested that the success of engineering education can be achieved by ensuring personal counseling, fostering a strong sense of community which nurtures both personal and academic development among students (Hrabowski III, 2003). Moreover, as indicated in the study conducted by Seymour and Hewitt (1997), the isolation and

alienation from faculty, administrators and peers have attributed to the fact that less women asking for help, making friends and connecting to a given community.

Not surprisingly, studies have shown that the connection women share with their peers is important for their identity construction and negotiation. In a study conducted in finding women's experience in a program which designs for women in science, technology, engineering and mathematics, researchers found that women students reported that the relationships they have with their peers are most encouraged and inspired since they are not only able to get support for academic, but also able to identify women who are in similar situations (Hyde & Gess-Newsome, 1999). In other words, in fields such as engineering which is usually male-dominated, women value not only the technical support from their peers, but more importantly, the emotional support from each other. It is important to note that, based on the research findings, allowing peer support network and caring community to grow and develop is essential for women to find belongingness and to be able to succeed.

Social Media

The popularity of social media has certainly affected many aspects of our social lives and is rapidly changing our way of communicating to one another. Social media, defined by Kaplan and Haenlein (2010), is "a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content" (p. 61). Specifically, "Web 2.0" refers to a platform that allows "continuously modified by all users in a participatory and collaborative fashion", and "User Generated Content" refers to "the sum of all ways in

which people make use of Social Media" (Kaplan & Haenlein, 2010, p. 61). The different types of social media includes: collaborative projects, blogs, content communities, social networking sties, virtual game worlds, and virtual social worlds (Kaplan & Haenlein, 2010). Boyd and Ellison (2007) contended that the availability of allowing its users to connect with each other and make visible of their social networks makes social networking sites distinguished themselves from others. Nevertheless, the existence of social media does not therefore entirely replace any older media forms. As Lievrouw and Livingstone (2006) summarized, "Rather, people's information and communication environments have become ever more individualized and commodified, integrating print, audio, still and moving images, broadcasting, telecommunications, computing, and other modes and channels of communication and information sharing" (p.1). They also argued that the linear assumption among production, text, and audience is no longer necessary in understanding the communication model in new media (Lievrouw & Livingstone, 2006). Without doubt that the increasing popularity of social media has proved that the new format of communication allow more individual interactions and information sharing. Just like Kaplan and Haenlein (2010) pointed out that, "The current trend toward Social Media can therefore be seen as an evolution back to the Internet's roots, since it retransforms the World Wide Web to what it was initially created for: a platform to facilitate information exchange between users" (p. 60).

As reported in Pew Internet Project on Social Networking, 67 % of online adults use social networking sites (Brenner, 2013). It is also reported that women are more likely to be on social networking sites (Duggan & Brenner, 2013).

Social Networking Sites

Social networking sites are defined as web-based services that allow individuals to, (1) create a public or semi-public profile within a bounded system, (2) connect a list of users within whom they share a connection in the social network community, and (3) find other users through the connections they have within network system (Boyd & Ellison, 2007). According to this definition, a social network site must have the feature that allows users to create their profiles. Then, with these visible profiles, users can establish connections with others users and maintain their relationships with these users. The primary study interests of social networking sites have centered on the issues of impression management and friendship performance, networks and network structure, online/offline connections, and privacy (Boyd & Ellison, 2007). Using social networking websites also enable users to share and exchange information, Facebook, Twitter, and LinkedIn are among the most popular sites. Facebook is a large online networking site which allows its users to become friends with each other and share text, pictures, videos, audio files, and join different friend groups. Twitter is "a micro blogging application that allows sending out short, text-based posts of 140 characters or less" (Kaplan & Haenlein, 2010, p.67). LinkedIn is a networking site explicitly designs for maintaining professional networks.

Specifically, among these different types of social media, social networking sites (sometimes called "social network sites", they are interchangeable in this study) have attracted large amount of users in the past few years. As reported in Pew Internet Project on Social Networking, 67 % of online adults used social networking sites as of December

in 2012 (Brenner, 2013). Logging in to social networking sites has become daily practices or routines to many of its users. Many of these social networking sites help users to maintain preexisting social networks, while some others help users to connect other users based on their shared interests (Boyd & Ellison, 2007). It has also been reported that social network sites enable users to maintain their existing relationships rather than allow users to meet new people (Boyd & Ellison, 2007; Ellison, Steinfield, & Lampe, 2007a).

Facebook

Facebook, began in 2004 as a Harvard only social network site, gained more than a billion monthly active users as of December 2012 (Boyd & Ellison, 2007; Facebook, 2013b). Reported by Pew Internet Project on Social Networking, 67% of online adult users use Facebook (Brenner, 2013). More importantly, study shows that Facebook users have more close relationships and get the most support from their social ties (Brenner, 2013). As stated on Facebook website, "Facebook's mission is to make the world more open and connected. People use Facebook to stay connected with friends and family, to discover what's going on in the world, and to share and express what matters to them" (Facebook, 2013b). In addition to allowing individual users to share information with one another, Facebook also allows companies, organizations, or bands to set up a "pages" to connect to other individual Facebook users and share information. As stated on the Facebook products website, the "pages" feature was first introduced in 2007, and "Pages are a public profiles that let artists, public figures, businesses, brands, organizations, and non-profits create a presence on Facebook and connect with the Facebook

community"(Facebook, 2013c). In other words, the pages feature allows individual users to be connected in a community setting where they can share their common interests and exchange information.

However, although social network sites share similar elements, it has been argued that the design of social network sites varies from site to site, and the distinctions constituted by different culturally homogeneous groups would influence users' motivation and uses, therefore fostering different community cultures (Boyd & Ellison, 2007; Hargittai, 2007). For instance, scholars found that social networking sites like Facebook can guide students when they entering an unfamiliar social environment (DeAndrea, Ellison, LaRose, Steinfield, & Fiore, 2011). Likewise, another study reported that social networking sites like Facebook not only help students establish and maintain existing relationships, they also assist the formation of student identities through the informal and cultural learning of "being" a student, online interactions and experience which allow roles to be learned, values to be understood and identities to be shaped (Selwyn, 2007). Therefore, it is reasonable to believe that using social networking sites, especially Facebook, will foster a unique online community based on its users and will potentially affect its users' perception of being a community member.

In terms of the use of Facebook by other business or professional groups, scholars found that the increasing popularity of Facebook allows organizations to become members of this online community and incorporate their marketing strategies to maintain relationships with their customers. For example, in their article which examined the use of Facebook by nonprofit organizations, Waters, Burnett, Lamm, and Lucas (2009) found

that among the 275 nonprofit organization Facebook profiles they examined, many of them have not incorporated the majority applications that were available to them on Facebook. Specifically, they found that many of these nonprofit organizations only adopted disclosure as their most often used strategy but not information dissemination and involvement when incorporating the use of Facebook (Waters et al., 2009).

Opportunities and Challenge of Social Media

In order to investigate the use of social media, three traits of social media will be examined in this section, including social media and identity building, social media and social support, and social media and networking.

As indicated in the study focused on identity management which was conducted by Hewitt and Forte (2006), "Because social networking communities are built to support presentation of self, identity management is likely to be a significant issue for participants in communities whose membership crosses perceived social boundaries and organizational power relationships" (p. 1). Since the presentation of oneself is essential in developing the use of social network sites, identity construction is often considered an important experience individuals would encounter during their use of social network sites. Similarly, a Dutch study on social network sites and teenagers suggested that the use of social networking sites is a way to obtain peers' opinions on themselves which ultimately influence the process of identity formation (Valkenburg, Peter, & Schouten, 2006). In this particular study, the scholars investigated the earlier social networking sites (e.g. Friendster and MySpace) for its influence on adolescents' self-esteem and well-being formation (Valkenburg et al., 2006). Moreover, they were able to identify that the

frequency of using these networking sites does not directly affect these teenagers' social self-esteem and well-being, but to receive positive feedback on their profiles does enhance their self-esteem and well-being while the receiving of negative feedback would then decrease their self-esteem and well-being (Valkenburg et al., 2006). It is important to keep in mind that based on previous research findings that women in engineering often experience the feelings of ambivalence and not belongingness when they are practicing engineering. Therefore, using social media could potentially open up ways for women in engineering to create and maintain relationships with others who work in the same profession and receive feedback and support from these relationships.

To be able to provide a social presentation and allowing self-presentation and self-disclosure are defined as the key aspects of social media (Kaplan & Haenlein, 2010). Social presence allows individuals to establish new relationships and maintain existing relationships with their communication partners. It is important to acknowledge that social presence is perceived to be the most significant factor in building a sense of community (Aragon, 2003). Social presence can be found in the application in communication, and it has been widely investigate in the realm of computer-mediated communication (CMC) environment. Gunawardena and Zittle (1997) defined social presence, "the degree to which a person is perceived as a 'real person' in mediated communication" (p. 9). According to Gunawardena and Zittle (1997), intimacy and immediacy are two concepts associated with social presence where intimacy relates to nonverbal factors and immediacy is a "measure of the psychological distance that a

communicator puts between himself or herself and the object of his/her communication" (p. 9). Moreover, immediacy enhances social presence (Gunawardena & Zittle, 1997).

Both intimacy and immediacy of certain media can be expected to influence the process of social presence (Kaplan & Haenlein, 2010). The social influence of communication partners often largely depends on the social presence (Kaplan & Haenlein, 2010). In other words, the use of social media would influence the relationship of its users on different levels which depend on their commitments. In fact, in CMC research, it is often reported that positive relationship can be found in online communities (Gunawardena & Zittle, 1997). Media richness theory is also employed in order to understand individuals' communication behavior on social media since the theory suggested that all communication seek for resolution to reduce uncertainty and ambiguity (Kaplan & Haenlein, 2010) . The other character of social media is self-presentation and self-disclosure. Stated by Goffman (2002), self-presentation is the desire that people have in social interaction in order to control the impression which other people have formed. People negotiate their identities through interpersonal interactions where they always try to manage other's perception on them (G. J. McCall & Simmons, 1978). While social media allow individual users to experience both social presence and self-presentation, it is reasonable to argue that social media could influence the process of identity construction. For women engineers, identity construction and negotiation are both ongoing process in their everyday interactions. As such, the activities of women engineers on social networking sites can be considered as a form of identity communication.

In a study conducted by Lamb and Davidson (2005) to examine the impact of information and communication technology on scientific professional identity construction, they found that the development and use of information technology enhanced many scientists' identities. In addition, they found that the use of communication technology among data collection, collaborative coordination and scientific interaction also challenge their perception on scientific expertise and professional identity (Lamb & Davidson, 2005). Moreover, in a study focused on the use of blogging on professional identity building among teachers, Luehmann and Tinelli (2008) found out that blogging, a social networking technology, allowed like-minded professionals to practice meaningful interactions and provides opportunities for identity building without geographical restriction. In this case, the formation of online professional community allows women engineers, as its users, to construct their own professional identities.

Likewise, social support is often considered a great benefit that social network sites (online communities) can offer, especially in health communication. It is recognized that online communities can provide mental health and social support for its user (Eysenbach, Powell, Englesakis, Rizo, & Stern, 2004). In their study focuses on the benefit of Facebook friends, Ellison, Steinfield, and Lampe (2007b) found out that the use of Facebook could have benefited college students who were experiencing low self-esteem and low life satisfaction. Moreover, a study also found out that social networking websites have been developed to increase connections among graduate students, faculty

and staff across campuses as well as to create peer-support networks prior to students arriving on campus (DeAndrea et al., 2011).

Furthermore, it is also argued that social network sites are able to connect both offline and online social networks, since people are often engage in looking for people they have through offline connection (Ellison, 2007). Many researches have been developed to study the relationships among online social networks, including the issues of exchange of information, emotional support, uncertain communication, and the communication to generate ideas, create consensus, support work, foster sociable relations, or support virtual community (Garton, Haythornthwaite, & Wellman, 1997). However, it is hard to separate the study of identity, social support and social networking, since they often intertwine and interact with each other during the process of identity construction. In summary, the popularity of social networking sites has offered the venues for a close look at women's experience in engineering.

CHAPTER THREE

THEORETICAL FRAMEWORKS

This study draws from the concept of intersectionality to guide the design of the research and ensure research questions were proposed and can be answered with a commitment to enhance and further the knowledge of women engineers and their experience of social media. Given that the current study focuses on women engineers, a unique group of women who constantly running into experience of exclusion and subordination, an employment of intersectional perspectives allows a more conceptualized interpretation and analysis of such experience.

As acknowledged by Kathy Davis (2008), "intersectionality offers endless opportunities for interrogating one's own blind spots and transforming them into analytic resources for further critical analysis" (p. 77). Intersecionality will be applied as the theoretical framework of the current study. First and foremost, the concept of intersectionality provides a primary and fundamental analytic framework to the given phenomena. In other words, it promises right questions will be asked in order to thoroughly examine the given phenomena. As a concept, intersectionality has been used in many feminist studies for "theorizing identity and oppression" in cases related to women (Nash, 2008, p. 1). In this study, with a focus on women engineers whose gender identity and professional identity are often in compete with one another, I intend to employ the concept of intersetionality to interrogate the experience of women engineers. In addition, according to Davis (2008), intersectionality addresses the fundamental and the most important concern within feminist scholarship in which it directly acknowledges

the issue of differences. Therefore, adopting interestionality in this study would provide a more complex yet fruitful understanding of women engineers' experience. Second, the utilization of intersetionality offers useful insights on adopting suitable research methods, which guarantees that research questions will be answered properly. It is because of the ambiguousness and incompleteness which inherently coincide with the development of intersectionality that the employment of this concept allows for an exploration of mix-method research. Moreover, the lack of defined intersectional methodology encourages researchers to use their own experience as analytic resources to help understand the phenomena. Last, by critically interpreting the current phenomena, intersetionality promises to further the discussion. As Davis (2008) mentioned in her article which she assessed the success of intersectionality, she pointed out that "with each new intersection, new connections emerge and previously hidden exclusions come to light" (p. 78). By exploring a new intersection, new understanding can be discovered to further help theorizing identity and oppression.

Intersectionality

Having been applied to many different disciplines including law, sociology, psychology, and education, intersectionality has been recognized as the "most important contribution that women's studies has made so far" (L. McCall, 2005, p. 1771). Basically, the concept of intersectionality intends to examine the intersection and interaction among ones biological, social and cultural identities such as gender, race, ethnicity, disability, sexuality, class and nationality. Specifically, intersectionality tries to analyze the relationships among these intersections and how they influence one another on multiple

and/or simultaneous levels (Knudsen, 2006). Intersectionality, "refers to the interaction between gender, race, and other categories of difference in individual lives, social practices, institutional arrangements, and cultural ideologies and the outcomes of these interactions in terms of power" (Davis, 2008, p. 68). Therefore, due to the complexities of an individual's experience, it is important for researchers to understand and examine the uniqueness of these experience using intersectional perspectives. More importantly, given that this study focuses on women engineers who belong to more than one predominant social category, a thorough examination of the complexities of their experience would certainly be enhanced through a lens of intersectionality.

The concept of intersectionality was introduced in her article about violence against women of color by Kimberlé Crenshaw (1991). The term "intersectionality" has been devoted to studies which inquired into women's experience of identity and oppression. Crenshaw (1991) argues that women of color are being marginalized, because their intersectional identity as both women and people of color are mutually shaped and respond to one or the other. The experience of belonging to at least two subordinated groups or multiple subordinated groups often make women of color more vulnerable and suffer from discrimination. Moreover, the ignorance of these intersectionality experience lead to failure to properly address the needs of women of color (Crenshaw, 1991). When refer to the multiple dimensions of black women's employment experience, Crenshaw (1991) mentioned that the simply sum of the traditional understanding of race or gender does not have the capability to fully captured the intersectionality experience within black women. Crenshaw (1991) also suggests that,

"aiming to bring together the different aspects of an otherwise divided sensibility, an intersectional analysis argues that racial and sexual subordination are mutually reinforcing" (p. 1283). In other words, according to Crenshaw (1991), when studying how the social world is constructed, it is necessary to take into consideration of multiple grounds of identity. In addition, Crenshaw (1991) indicates that the concept of intersectionality can be used as "a way of mediating the tension between assertions of multiple identity and the ongoing necessity of group politics" (p. 1296). In this study, women engineers' experience was captured in consideration of both gender and professional identities.

Addressing the issue of difference, the concept of intersectionality provides a "handy catchall phrase that aims to make visible the multiple positioning that constitutes everyday life and the power relations that are central to it" (Phoenix & Pattynama, 2006, p. 187). Likewise, noted by Crenshaw (1991), "when one discourse fails to acknowledge the significance of the other, the power relations that each attempts to challenge are strengthened" (p. 1282). In other words, disproportionate punishment could be forced to a specific racial group and contribute to the stereotype this particular group received in public when the important intersection of race and gender was failed to acknowledged by dominant discourse (Crenshaw, 1991). In fact, the intersections of multiple vectors of power have been constantly constituted one's identity (Nash, 2008). One's identity is never a solely expression of a person's biological identity – who he/she is when he/she was born – but also, most importantly, how society has inflicted its power on this person when he/she grow up and interact with others. In the introduction of her well-known

paper which coined the concept of intersectionality, Crenshaw (1991) offered her insights on the embrace of identity politics, she contended that the once private and aberrational issues such as battering and rape are now seen as largely affecting women as a class. Individuals are no longer being recognized as single actor but characterized as a whole in identity-based politics (Crenshaw, 1991). That being said, the employment of intersectionality inherently deems an examination of power relations in which we interrogate how social power is inflicting on women, people of color, gays and lesbians and others. One the one hand, it is important to note that, this study primary examines the activities of women engineers on a given Facebook Page, from which these activities can be seen as everyday interaction of the multiple identities of women engineers. On the other hand, since intersectionality corresponds with Foucauldian perspectives on dynamic processes of power relations (Knudsen, 2006; Staunæs, 2003), investigating the presence of women engineers on social media has to account for the multiple and shifting identities interactions of women engineers in different contexts so that these interactions can be understood in relation to one another. For instance, a female student in engineering may perceive an engineer identity differently than a professional woman engineer, and therefore result in different approaches in searching for social support through their online activities. Moreover, it is important to recognize that these individual experience are not only individually experienced, but also reflect the power relations among different social groups which contribute to the predominant social categories (Shields, 2008). In other words, although the activities of women engineers on social media are limited, they can still yield meaningful results.

Exploring how race, gender, and class are elaborate with one another, intersectionality also coincides with feminist inquiry of situated knowledge (Haraway, 1988). Situated knowledge in general refers to "how people may understand the same object in different ways that reflect the distinct relations in which they stand to it" (Anderson, 2012). In other words, one's gender, class, race, and nationality or other identities may influence how he/she understands a given situation and therefore produce situated knowledge depends on his/her position and locality. For instance, women engineers at different ages may experience different obstacles from work or family. The idea of situated knowledge encourages researcher to take into account of every intersection which influences women engineers' experience and allows researcher to bring her own experience into the research to evoke more profound interpretation. In her article focusing on "situated knowledge", Haraway (1988) argued that "only partial perspective promises objective vision", and feminist objectivity is about "limited location and situated knowledge" (p. 583). As Haraway (1988) commented on feminists' searching for a better account of the world, she contended that:

> Feminists have stakes in a successor science project that offers a more adequate, richer, better account of a world, in order to live in it well and in critical, reflexive relation to our own as well as others' practices of domination and the unequal parts of privilege and oppression that make up all positions (p. 579).

The use of intersectionality is considered to have the ability to enhance the reflexivity of the researcher by allowing the incorporation of the researcher's own intersectional location (Lykke, 2005). According to England (1994), reflexivity is "self-critical

sympathetic introspection and the self-conscious analytical scrutiny of the self as researcher", and "a more reflexive and flexible approach to fieldwork allows the researcher to be more open to any challenges to their theoretical position that fieldwork almost inevitably raises" (p. 244). Without doubt a more reflexive inquiry into women engineers' experience with social media must take into consideration of my situated knowledge about women engineers and social media. Similarly notified by Davis (2008), the employment of intersectionality can be used as an analytic resource for a researcher who is willing to use her own social location. Therefore, the notion of reflexivity allows me, a researcher who is not a woman engineer, to take a close look at the phenomena in the production of self-critical and accountable for feminist inquiry (Lykke, 2005). In particular, this study not only reflects the experience of women engineers from their variety of marginalized locations, but also responds to my very own experience.

More importantly, stated by Davis (2008), intersectionality "promises an almost universal applicability, useful for understanding and analyzing any social practice, any individual or group experience, any structural arrangement, and any cultural configuration" (p. 72). In other words, intersectionality is "not race-class-gender, but also age, ableness, sexual orientation, to name the most salient" (Shields, 2008, p.303). Centering on the online practice of women engineers, the primary focus of this study will be looking at how women engineers negotiate both gender and professional identities. As a result of a lower representation in engineering, as well as being subordinated to the dominant culture of engineering, women engineers' opinions are often left out or marginalized in the mainstream. However, with the popularity of social media, it is

reasonable to believe that meaningful conversations within groups of women engineers have emerged. The goal of this study is to let the unheard voices from women to be heard and to provide insights of women's experience so that more changes in the field could happen. As noted by Stephanie Shields (2008) in her article which examines intersectionality perspective from a gender lens, intersectionality is especially an urgent issue for researchers who are seeking to promote positive social change.

Empirical Studies

Applying intersectionality as theory and methodology, many researches have conducted in different areas such as politics and leadership, the life course, law, health, sexual identity development, HIV/AIDS research, and coalition building (Bruning, Bystydzienski, & Eisenhart, 2012). Although intersectionality is widely used to address the complexities of identity and the experience of subordination, only a few studies explicitly used intersectionality as a theoretical framework to study women engineers in terms of the relations among gender and other different forms of social categories. For example, a study focus on addressing the underrepresentation of women in engineering employed the concept of intersectionality to understand how gender, race/ethnicity and class intersect with each other and influence young women's choice of pursuing careers in engineering. Another study adopted the concept of intersectionality to explain the process of competing identities among women of color in science. Moreover, few scholars have identified the relation between intersectionality and social media (technology) which opens up possibilities to explore the interconnections within these

two realms. Several studies were selected to be reviewed here to glance over some current practice of intersectionality.

In the first study, Monica Bruning (2012) and the fellow researchers use intersectionality as a framework to understand how and why young women from diverse social backgrounds are more or less likely to study science and engineering and go on to pursue careers in these fields in the future. Presented in the 2012 Women in Engineering Proactive Network (WEPAN) national conference, these researchers are trying to answer the question that has been addressed in many studies about why women are underrepresented in engineering. Based on data collected from 132 tenth-grade high school girls, the study evidences that young women's interest, experience, and persistence in engineering were subjects to be affected by the combined effects or intersections of gender, race/ethnicity and class (Bruning et al., 2012). Lastly, tailored solutions which meet both academic and career interests within the context of these young girls' lives are proposed by these researchers (Bruning et al., 2012).

The second study focuses on three women of color in science-based fields with the goals to find ways to support similar women and study the dynamics of inequity within and beyond science (Johnson, Brown, Carlone, & Cuevas, 2011). Angela Johnson, Jaweer Brown, Heidi Carlone and Azita Cuevas (2011) examine the successful pathways of a Black public health expert, a Latina toxicology researcher, and an American Indian pharmacist has taken through the terrain of science. Using intersectionality and practice theory, Johnson and her colleagues (2011) identify that authoring of identity is an ongoing process where the opportunities to author legitimate of science identities were

inhibited by these women participants' location in the "matrix of oppression" (p. 343). In this study, the concept of competing identities was explicitly used to explain the experience of competition between science identities and identities as women of color among research participants. By looking at how these women of color resolve the conflicts between science identities and other identities they valued as women of color, the researchers argue that although some women manage to survive and build successful careers, a collective agency approach is urged (Johnson et al., 2011).

The last study is an essay written by Amber Johnson (2012) with a focus on how social media can be seen as a space to explore intersectionality by looking at the case of Antoine Dodson. While asserting social media provide a space to looking intersectional identities in a virtual world, Johnson (2012) argues that, "because our identities fluctuate in a milieu of negotiation, conceptual change, and mediated representations, it is important to look at the ways in which social media challenges the way we perform, authenticate, appropriate, and exploit intersectional identities" (p. 166). Examining the case of Antoine Dodson, an internet celebrity, Johnson (2012) contends that because of the possibility of new media, Antoine Dodson was able to told his own version of story in a way that "complicated identity and invited others into his intersections of race, class, sexuality, and gender" which also demonstrated that "gendered and racialized boundaries are changing" (p. 178). When finalizing the thoughts about social media and intersectionality, Johnson (2012) states that, "because of the lack of gatekeepers, limitless space, and asynchronous nature, social media allows for less inhibited constructions of sexuality, gender, class, and race", and more importantly, social media "allows for

individuals to redefine their identities in more complex ways, insert their bodies into the social networking landscapes, and exploit social media as a form of impression management and individual change" (p. 179).

All these three studies utilize intersectionality as a theoretical framework to interpret and analyze a certain aspect of social phenomena. However, no studies have explicitly or implicitly examined women engineers' presence and participation in social media. The interconnections of these women's presence and activities in social media and the complexity of their identities have yet to be explored. Is there any identity competition and negotiation occurring in social media communication? Do social media provide a space for women engineers to build up support networks? Can social media fulfill the criteria and possibly serve as tailored solution to address the underrepresentation of women in engineering? Therefore, the purpose of the current study is to attempt to answer these questions.

Critiques of Intersectionality

Although intersectionality has widely adopted for research in different disciplines, the concern of how it should be used has coupled with its success. Nash (2008) summarized three theoretical and political purposes of intersetionality: 1) it destabilized race/gender binaries and enable for theorizing identity in a more complex fashion; 2) it provides a vocabulary to respond to critiques of identity politics; 3) it invites more studies in both theory and practice about multiply marginalized subjects in feminist and anti-racist works. However, Nash (2008) also contended that there has been four major concerns center around the adoption of intersectionality: a lack of clear defined

methodology, the use of internationality can typically be found in studies focus on black women, the blurred definition of the concept itself, and the empirical validity of intersetionality.

Davis (2008) points out that intersectionality is no doubt a concept that is ambiguous and open-ended. Similar concern was expressed by Shields (2008) where she argues that despite a fundamental agreement has been established about the definition of intersectionality, different ways of constructing intersetionality in research practice exist. Furthermore, she argues that many researches fail to grasp the idea of "mutually constituted categories" when applying intersectionaltiy (p. 304). Also noted by Ange-Marie Hancock (2007), when examining intersectionality, it is important to focus on the processes of multiple and simultaneous exclusion, rather than simply adding two sets of findings together.

However, even there are risks and challenges of adopting intersectionality in research, Davis (2008) also claims that it is because of "its lack of clear-cut definition or even specific parameters" that intersectionality can be used in almost "any context of inquiry" (p. 77). In addition, Davis (2008) states that the employment of intersectionality not only initiates the discovery of any unknown phenomena, it also "promises to yield new and more comprehensive and reflexively critical insights" (p. 77). In the same vein, given that this study aims to examine women engineers' presence in social media which is a process of discovery and an emergent phenomenon, adopting qualitative methods will be "more compatible with the theoretical language and intent of intersectionality" (Shields, 2008, p. 306). Moreover, noted by Shield (2008), "intersectionality theory, by

virtue of its description of multidimensional nature of identity makes investigation through qualitative methods seem both natural and necessary" (p. 306).

CHAPTER FOUR

METHOD

To explore and gain insights for the proposed research questions, based on previous literature review, three approaches will be applied for the current study. Since the purpose of this research is to investigate women engineers' social media activities using an interpretive, feminist approach and intersectionality concept, as indicated in the previous discussion, intersectionality deems an investigation of power relations and coincides with feminist inquiry of situated knowledge. The locality and situation of any given phenomena are important when employing the concept of intersectionality. Therefore, qualitative research methods will be more suitable to give rise to findings as the phenomena can be examined in their natural settings and allow for an interpretation of every possible intersection exposed in women engineers' experience. However, due to the overall underrepresentation of women engineers, limited social media activities of women engineers are available for research. Therefore, the current study will be generally framed as a case study which constituted multiple methods including thematic analysis and survey methods. Triangulation, used in many multi-methods researches, is "a method used by qualitative researchers to check and establish validity in their studies by analyzing a research question from multiple perspectives" (Guion, Diehl, & McDonald, 2011, p. 1) . Qualitative research is inherently multimethod in focus and "the use of multiple methods, or triangulation, reflects an attempt to secure an in-depth understanding of the phenomenon in question" (Denzin & Lincoln, 2000, p. 5) . Moreover, it is argued that "the combination of multiple methodological practices,

empirical materials, perspectives, and observers in a single study is best understood, then, as a strategy that adds rigor, breadth complexity, richness, and depth to any inquiry" (Denzin & Lincoln, 2000, p. 5). Primary data are was obtained from the extended Facebook Page visits and observation, organizations official websites visits, other social media platforms activities observation. Then, a thematic analysis was used to examine the identified themes from social media activities with a particular focus on an organization's Facebook page. Lastly, an informational survey with both multiple choice questions and open-ended questions was conducted and used to supplement the primary data sources.

Outlining the methodological approaches, detailed explanations was provided on each of the following sections: case study approach, sites of study, thematic analysis technique, and survey instrument design.

Case Study

Because limited social media activities can be identified among women engineers, it is important note that this directly affects the overall research design and also determines the primary method that has been employed in this study. Women engineers, just like other professional practitioners, have founded several professional organizations to address their own needs. An informal observation was conducted before selected the site for this study. First, a general Google search was conducted to obtain a general observation of the online activities of women engineers. Both key words "women engineers" and "women in engineering" were used to initiate an online activity observation. Indicated by the search results, there are many websites particularly associated with professional organizations of women engineers. However, among these

websites, many of them are in fact local chapter websites of a given organization, and some of them are university branches websites of a given organization. Moreover, based on a general evaluation of the information updates on these websites, some of these websites are well designed and maintained while some of them are not. For the purpose of this study, I pay extra attention on the social media footprint on these websites. As such, many of these websites have a clearly display of social media icons including Facebook, LinkedIn, Twitter, and YouTube. However, although social media activities are available, some of these organizations only maintain their Facebook pages, while some other groups are relatively more active on Twitter. There were also several LinkedIn Groups and YouTube accounts related to these professional organizations, but activities on these two groups are not as active as their Facebook pages. The overall limited online presence of women engineers made it difficult to conduct a large scale quantitative study. In addition, due to the constantly changing features of social media platforms, this has made it difficult to collect data before some features' availability.

However, the limited availability of women engineers' online presence should not hinder the current study to generate understanding of these activities. As such, the current study will be framed as a case study to initiate a discovery and inquiry into women engineers' online activities.

Case study is "an intensive, holistic description and analysis of a single instance, phenomenon, or social unit" (Merriam, 1988, p. 21). As an empirical inquiry, case study "investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident"

(Yin, 2008, p. 18). In particular, it allows the investigators to "retain the holistic and meaningful characteristics of real-life events" (Yin, 2008, p. 4). Therefore, this approach is particularly effective when it is impossible to isolate the phenomenon from its context (Yin, 1994) and the researchers are examining contemporary events (Yin, 2008). More importantly, a case study approach allows researchers to explore and understand complex social phenomena (Yin, 2008), and enables researchers to use a variety of data sources which guarantees a variety of lens were used to analyze the phenomenon so that different aspects of the phenomenon can be revealed and understood (Baxter & Jack, 2008). In other words, there are no universal sets of method or a particular set of method should be used for case study data collection or data analysis (Merriam, 1998).

The first rationale to use a case study approach to frame this study is based on the fact that limited online activities are available to conduct a broad scale study on the given phenomenon. With research questions specifically focus on women engineers and their activities in social media, a case study design is good for answering these practical problems, because case studies "concentrate attention on the way particular groups of people confront specific problems, taking a holistic view of the situation" (Shaw, 1978, p. 2).

Second, previous studies which explicitly analyze the experience of women engineers have often employed qualitative research methods. Similarly, researchers often choose to use qualitative case studies because they are interested in insight, discovery, and interpretation of the phenomenon (Merriam, 1998). In addition, it is considered that the case study provides a rich and thick description of the phenomenon (Merriam, 1998).

Given that the theoretical framework of this study is intersectionality which also prefers a qualitative methodological approach. Therefore, it is methodologically appropriate to use case study approach since the current study aims to explore the experience of women engineers in social media.

The third reason for using a case study approach is that very limited studies have examined social media activities of women engineers. Research concerning the experience of women engineers is predominantly focused on institutional and educational levels, while research examining the intersection of women engineers and new technology is numerically lacking. As a result, it is crucial for this study to explore and examine the gaps within this realm. Furthermore, given that the current study is both exploratory and discovery, new meaning of phenomenon could have emerged from examining these activities so that readers' experience can be extended (Merriam, 1998).

However, the challenge remains for using a case study approach since the researcher is often the primary instrument of data collection and analysis (Merriam, 1998). As noted by Sharan Merriam (1988): "The investigator is left to rely on his or her own instincts and abilities throughout most of this research effort" (p. 42). This limitation also results in another concern of using case study in research where its lack of rigor in data collection, construction, and analysis can affect the reliability, validity, and generalizability of the research findings (Merriam, 1998). In this study, drawing on previous research on both women engineers and social media, I will critically examine the data within an interpretive, feminist framework and apply the concept of intersectionality.

Sites of Study

As noted in previous discussion, limited online activities can be identified among women engineers. Hence, the sites of study was chosen based their relevancy and significance to the current study. The data for this study was collected through a two-step analysis. First, a general observation of women engineers' online presence was conducted to offer background knowledge. Then, the Facebook page of Society of Women Engineers (SWE) was examined using thematic analysis method.

To be able to capture a holistic understanding of women engineers' online presence, a Google search (used key words like "women engineers" and "women in engineering") was conducted to identify websites of professional women engineers organizations since these website can represent a valuable demonstration of women engineers' online presence. In order to perform a manageable analysis, only the first ten pages of Google search results were being analyzed. Then, each search result was individually examined using the following criteria: the accessibility of the website, the maintenance of the website, the content of the website. The accessibility of the websites assured the websites are assessable for general public. The maintenance of the website indicated the websites are being updated regularly. Lastly, the content of the websites entailed the national and international influences of the organizations. In addition, organizations' local chapter websites were excluded from this study since they do not have national or international impacts. The three criteria filter process was employed to narrow down the search results so that only larger domestic and international women engineer organizations are being analyzed here. After that, three major organizations'

websites were selected as representation of women engineers' online presence based on another set of criteria which examined the history of the organizations, the numbers of current members of the organizations, and the activities held by the organizations. As a result, these three organizations are IEEE Women in Engineering (WIE), Society of Women Engineers (SWE), and Women in Engineering ProActive Network (WEPAN). Based on the given criteria, these three organizations can be treated as the facets of women engineers' social media presence since they are well-known, respectful, and influential organizations. Based on the preliminary website examination, each of these organizations has a relatively long history in advancing women in engineering with members from around the world. They also host annual events and meetings to address the issues of women in engineering. It would be reasonable to believe that people who wanted to find out information about women engineers would use similar methods to identify relevant information that meet their expectation. Then a thorough exploration of these three websites was conducted in order to document evidence of women engineers' use of social media.

The Society of Women Engineers (SWE) Facebook page was chose to be the major study site because it is by far the largest active online community with a specific interest in women engineers. As the Facebook page was created on May 6, 2008, at the time of this research, the page has received 15,795 "likes" and generated 1, 018 "talking about this". The SWE Facebook page is actively updated compared to other professional women engineer organizations' Facebook pages. More importantly, the SWE Facebook page management team employs communication strategies to engage and motivate the

Facebook users to participate in this online community. I was able to found an online article titled "Case Study: The Society of Women Engineers and Social Media". This article talks about how SWE adopted new strategies to get more member participation on their social media websites (David James Group, 2010). In this article, the author specifically indicated that the employment of new social media strategies is to "hoped that SWE members would find an informal venue to share experiences, advice, stories and questions with other members across the globe" (David James Group, 2010). Therefore, it is reasonable to believe that the SWE Facebook page is a valuable site to study as it can provide rich and meaningful conversation about women engineers' personal experience, and can be considered a demonstration of how women engineers participate in social media. These interactive conversations will be analyzed using a thematic analysis method to give arise to the comprehensive understanding of the activities being observed.

In addition to the SWE Facebook page, other social media activities engaged by women engineers and previously identified women engineers' organizations were also included to be studied in order to clarify and fill in possible gaps in the SWE Facebook page analysis. These social media activities included other available online presence of women engineers in Facebook, LinkedIn, and Twitter. Given that a case study approach is used in this research, a thorough understanding of research questions can only be gained from variety types of evidence because no single type of evidence can guarantee a complete understanding of the given phenomenon. As a result, be able to include other social media activities would allow me as a researcher to "retain the holistic and

meaningful characteristics" of these women engineers' online presence and give rise of the understanding from the nature setting of this phenomenon.

Thematic Analysis

In this study, the SWE Facebook page and other related social media activities was analyzed within a framework of thematic analysis. Based on the fact that the SWE Facebook page constitutes an online community with a mix of text, pictures, videos, it is reasonable to approach these combination of artifacts through a thematic method.

As a widely used qualitative analytic method, thematic analysis is "a method for identifying, analysing and reporting patterns (themes) within data" (Braun & Clarke, 2006, p. 79). In a thematic analysis, the exclusive focus is the content, in which "what" is said is the primary attention (Riessman, 2007). Moreover, thematic analysis is flexible as it can be "a method that works both to reflect reality and to unpick or unravel the surface of 'reality'" (Braun & Clarke, 2006, p. 81). Given that this study focuses on interpreting women engineers' experience in the context of social media, it is important to draw understandings from the recurrent stories that developed in the everyday interaction of women engineers in social media so that an overall better understanding of their experience can be examined. In particular, thematic analysis allows meanings to arise from individual stories and makes it possible to create social identities, group belonging, and collective action (Riessman, 2007). It is important to note that, in this study, the stories or data being analyzed were not selected based on their statistical significance but based on their richness in telling stories and their ability to develop a unique intersection.

Although thematic analysis can be used to examine the stories developed in interview conversation, group meetings, and other written documents, Facebook page, where it constitutes a combination of texts, pictures, videos, however, is still a new realm that needed to be fully studied. Nevertheless, numerical studies of Facebook and other online social networking websites help to illuminate that the online activities on these websites are just another form of everyday interaction and practice that individuals employ to express the identities. As Riessman (2007) argues that thematic analysis is particularly effective for investigators who will encounter stories in their research data, so that they can use a strong theory as a source to link everyday, seemingly insignificant acts that people engage in with social change processes. As such, in this study, drawing on a general feminist approach, it is assumed that the everyday activities of women engineers on the SWE Facebook page and other social media presence are forms of identity communication and negotiation.

According to Braun and Clarke (2006), there is no single right way to conduct reading for thematic analysis, but generally researchers or investigators can follow a six phases of analysis, which includes: (1) familiarizing yourself with your data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, (6) producing the report. As such, I will conduct the thematic analysis of this study by first familiarize myself with the SWE Facebook page. Detailed description of the SWE Facebook page will be provided in findings and analysis section of this study. Then, I will conduct a close reading of all the available posts on the SWE Facebook page, however since not all the posts are relevant to this study, I will purposeful select the posts

that rich (in terms of depth and length) enough to be studied. After that, these posts will be copy and put into a new document, and I will start the initial coding of these posts and looking for emerging themes. Later, these themes will then be checked for variability and consistency by a process of reading and re-reading, as well as a back and forth process of reading the primary data (posts from SWE Facebook page), activities in other social media platforms and checking for other scholarly references.

Survey

The third method applied for this study is an online survey questionnaire with open-ended questions. An informational survey included both multiple choice questions and open-ended questions was conducted and used as the supplement to primary data sources.

A survey is generally understood as "means for gathering information about the characteristics, actions, or opinions of a large group of people" (Pinsonneault & Kraemer, 1993). In this study, survey method is adopted as a data collection tool which provides additional information about women engineers' perception of using social media. In contrast to survey research, no statistical tests were conducted to examine the statistical correlations among the collected data. However, adopting an informational survey still provides valuable results to researchers who are attempting:

> to answer questions that have been raised, to solve problems that have been posed or observed, to assess needs and set goals, to determine whether or not specific objectives have been met, to establish baselines against which future comparisons

> can be made, to analyze trends across time, and generally, to describe what exists, in what amount, and in what context (Isaac & Michael, 1995, p. 136).

More importantly, using survey allows researchers to obtain a quantitative understanding of certain aspects of a given population, to collect information that are subjective which can be used to constitute the data being analyzed, to be able to generalize findings to larger population using the collected data (Pinsonneault & Kraemer, 1993). In an article written by Wright (2005) which identifies the advantages of online survey research, he suggests that conducting survey research online reduces research's time and effort and has the ability to access to participants who are difficult to reach and who are in distant locations.

However, multiple concerns also surrounded by the use of online survey research which include the validity of the sampling and data collection, as well as the design, implementation, and evaluation of an online survey (Wright, 2005). Moreover, according to Harnois (2012), "many contemporary scholars – both feminists and otherwise – continue to see quantitative survey research as being at odds with feminist theory" (p. 6).

Although uncertainty issues over the use of online survey can be troublesome, it is also argued that "the technology for online survey research is young and evolving" (Wright, 2005). The use of survey questionnaire is a way to ensure an in-depth understanding of the phenomenon can be gained as multiple data sources is encouraged by a case study approach and thematic analysis also aims for a check for validity and reliability. In addition, due to time and space limitation, an online survey questionnaire can save time both researcher and participants and allow them to share their experience

without concerns about time and distance. As Harnois (2012) contends that, "quantitative research has been an important tool for understanding, documenting, and challenging gender inequalities and social inequalities more generally" (p. 8).

The main purpose of use an online survey questionnaire is to find out what kind of perceptions women engineers have towards using social media. It is important to note that, the online survey is only providing sufficient understanding of the phenomenon, and the results are not going to be analyzed in terms of statistical significance. The online survey questionnaire was composed of a few basic demographic questions, several open-ended questions, as well as a few Likert scale questions, so that a more complex and holistic understanding of how women engineers use social media can be captured. Questionnaires concerned why women engineers want to use social media; how women engineers are using social media; and what expectations do women engineers have over their use of social media. For the survey data collection, email invitations were sent out to local chapters' presidents using the contact information they provided on the SWE membership website. Only members of the SWE were invited to participate in the survey since they have been identified as professional women engineers or collegiate level soon-to-be women engineers by the organization.

CHAPTER FIVE

FINDINGS

The current study aims to examine women engineers' experience in social media with a focus on how women engineers' communicate their identities in social media. In this chapter, key findings obtained from a thematic analysis of a professional women engineers organization's Facebook page and detailed information gathered from an online survey questionnaire are presented. Findings are presented based on the order in which research questions were asked, along with supporting statements and quotes from available materials.

RQ1: Which social media are women engineers using?

The first research question asks a question regarding the overall social presence of women engineers on social media. An overall big picture of women engineers' social media presence and activities is provided here to lay out a first impression of women engineers' social media presence. The general observation of women engineers' social media usage indicates that the social media adoption among women engineers is similar to the general public. It is important to keep in mind that the observation only signifies the activities of some women engineers but not the population as a whole. Based on the observation, Facebook, LinkedIn, and Twitter are perceived to be the most popular social media platforms that have been used by major professional women engineers' organizations.

On the WIE website, the social media icons are lined up at an easy to find up right corner of the main web page along with a "share" function icon. These social media icons

include Facebook, Twitter, LinkedIn and YouTube. In addition, a bigger logo of Facebook was placed at the top right function section which indicates “Connect with IEEE WIE” along with additional instructional sentence says “Like WIE on Facebook” (see Figure 5.1). However, the upper icon of Facebook is connected to the general IEEE Facebook page, while the lower bigger logo of Facebook is connected with the WIE Facebook page. Although WIE is perceived to be an affiliated organization with IEEE, the duplicated Facebook logos can easily cause confusion.

On the website of SWE, several social media icons can be found at the up right corner. As indicated by the icons, SWE owns Facebook, Twitter, LinkedIn accounts. There is also a Tumblr icon appeared in the social media section. However, all these social media icons are not in their original colors and shapes as they have been redesigned to match the colors and themes of the SWE website (see Figure 5.2). It is important to note that the SWE website has incorporate Facebook features which allow users to immediately share web content on their own Facebook pages through clicking buttons such as “Like” or “Send” (see Figure 5.3).

The last website, which belongs to the WEPAN, looks relatively simple in design. There is no easy to find social media integrated features on the website but only a Facebook icon at the very bottom of the website.

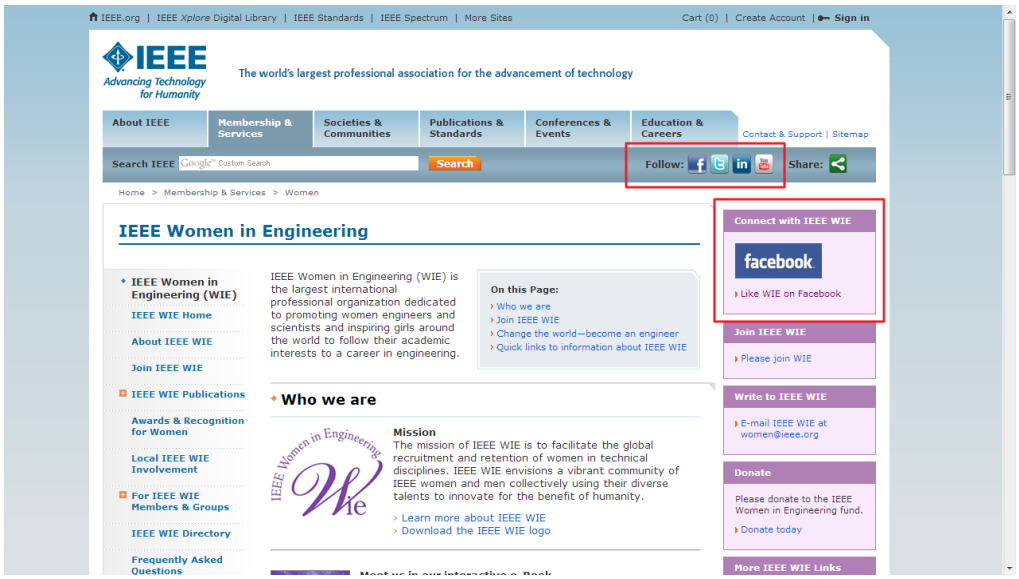

Figure 5.1. WIE website

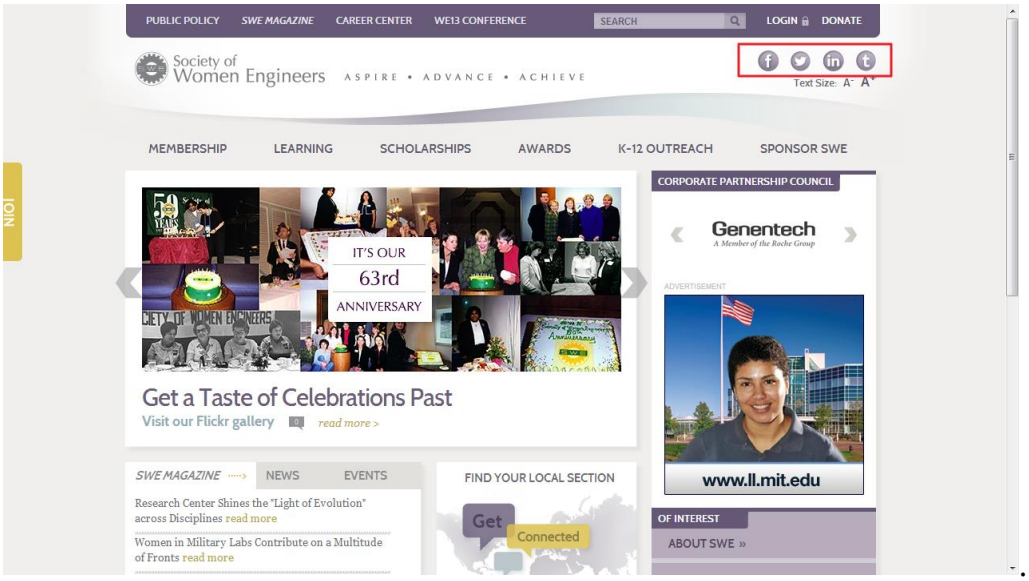

Figure 5.2. SWE website

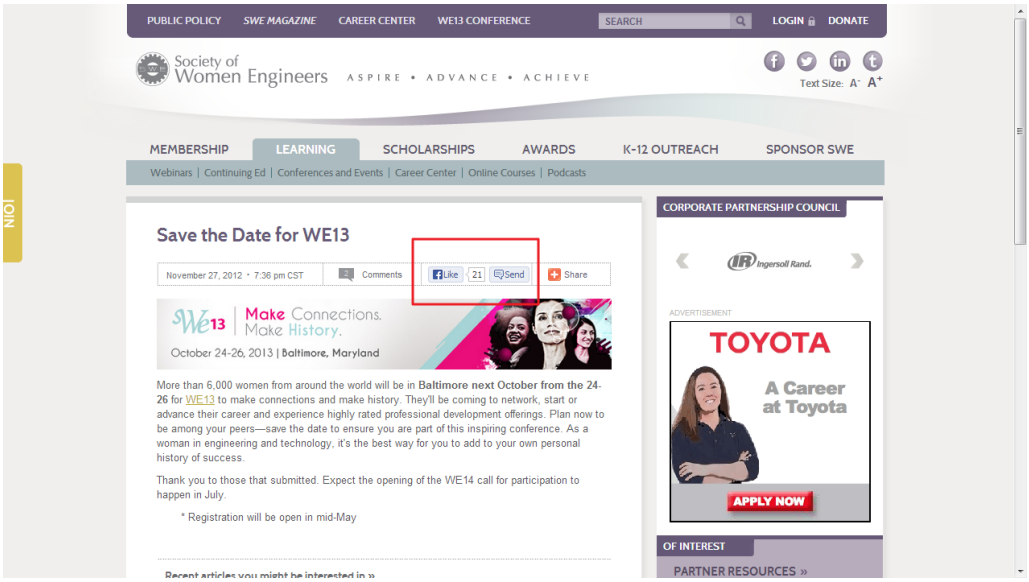

Figure 5.3. SWE Facebook features

In order to obtain a better understanding of how the three major social media platforms have been used by women engineers, I will individually review the activities that these three organizations engaged on Facebook, LinkedIn and Twitter. This review may not fully capture the detailed aspects of how these organizations use social media; however, it will paint a big picture and help offer background knowledge for further discussion. In addition, a trend of how women engineers use social media can be therefore evidenced.

Facebook. First, I will review the Facebook page of WIE. At the time of this research, the page has received 50, 717 “likes” and generated 2, 601 “talking about this". According to the Facebook Help Center, “People Talking About This is the number of people who have created a story from your Page post. Stories include: Sharing, liking or commenting on your post; Answering a question; Responding to an event; Claiming an offer” (Facebook, 2013a). Indicated by the WIE Facebook timeline, the organization

joined Facebook on August 9, 2010. Most of the posts on the Facebook page are information sharing about the organization's upcoming events and news sharing of women in engineering in general. Having international members distinguishes WIE from other organizations of women engineers. As a result, many of the posts on the Facebook page are a showcase of event pictures contributed by its international members. Second, a short review of SWE Facebook page is offered here as I will provide a more thorough description of the page in the later section of this thesis. At the time of this research, the page has received 15, 795 "likes" and generated 1, 018 "talking about this". Indicated by its timeline, SWE joined Facebook on May 6, 2008 which is two years earlier than WIE. However, in addition to showing when SWE joined Facebook, SWE Facebook timeline also indicates it was founded in 1950. Despite the SWE Facebook page revived less number of "likes" than the WIE Facebook page, the overall interaction among its users were considered to be more active. In addition to sharing organization events information, interactive online discussion of being an engineer or working in engineering can be found on the SWE Facebook page regularly. For instance, the following question, "what are you doing today to inspire the next generation to be that engineer" along with a motivation poster was pinned at the top section of the page and received 62 "likes". Lastly, compared to the WIE and SWE Facebook pages, the WEPAN Facebook page is considered to be more low-key. The organization joined Facebook on August 3, 2011, and received 209 "likes" and 39 "talking about this". Most of the posts were information sharing for upcoming events of the organization and general information about issue of women in STEM. However, many of the posts received no active user responses.

LinkedIn. Although a LinkedIn icon is displayed on the WIE website, no official LinkedIn group can be found under the name of IEEE WIE; however, several groups created by local chapters of WIE exist on LinkedIn. It seems like because of WIE's affiliation with IEEE, the members tend to use the already existing IEEE LinkedIn group instead of creating a separate group for WIE. While there is no LinkedIn icon displayed on the WEPAN main website, a members-only LinkedIn group created by the current management team of WEPAN can be found through a search conducted on LinkedIn website. Indicated by the group information, the WEPAN LinkedIn group was created on April 8, 2009 and has 64 members so far. In this case, only SWE has been promoting its own LinkedIn group on its website. The SWE LinkedIn group was created on March 11, 2008, and has a total of 14, 542 members at the time of this research. The SWE LinkedIn group is also a members-only group which means permission is required for users to share or start a discussion in the group. In addition, based on my experience of joining SWE LinkedIn group for research data collection, discussion or information posted by users have to be approved by the group manager.

Twitter. Similar to what I have found with the use of LinkedIn, the Twitter accounts of both WIE and WEPAN are relatively not as active as the SWE account. The WIE account has only 4 tweets and 8 followers, and all tweets seemed to be newly posted. The WEPAN account is more active than the WIE account. At the time of this research, the account has generated 134 tweets and 431 followers. As indicated by the available tweets, the use of WEPAN's Twitter account appeared to be not consistent since there are several long periods of time which no tweets were generated. In terms of SWE, the

overall activities among its account seem to be more consistent and dynamic. Both original tweeting and retweeting activities can be found on SWE Twitter account. Moreover, at the time of this research, the SWE account has generated 2, 493 tweets and 6, 521 followers in total. Based on the observation, the tweets appeared on the SWE Twitter account has a great diversity in terms of content.

Lastly, to summarize the observation for the first research question, women engineers use mainly Facebook, LinkedIn, and Twitter. Among these three social media platforms, Facebook is so far the most popular platform that adopted by women engineers. Observation also showed that compare to the other two organizations' use of social media, SWE is more active on social media.

RQ2: How do women engineers use social media?

A thematic analysis of a Facebook page which belongs to a professional organization of women engineers is provided and then substantiated by supporting materials and quotes draw from accessible public data. First, I will provide an overview of the SWE Facebook page in order to introduce some basic features of the Facebook page. Then, a thematic analysis of the Facebook page will be applied to demonstrate the communication activities among women engineers in a particular online community. Several relevant themes will be identified to answer the second research question.

Before I demonstrate the emerging common themes from the analysis of the Facebook page, I want to first describe this online community being studied. As an online community, the SWE Facebook page has several unique features which makeup its community culture (see Figure 5.4). First, dynamic use of graphics and texts are being

incorporated on the SWE Facebook page. For instance, the cover photo of the Facebook page reflects the current major event of the organization. As indicated in Figure 5.4, the top page cover photo is a message about encouraging members to renew their membership. With a very dynamic color background, the cover photo featured two women who are smiling. It is interesting to see that both women are posing with their arms crossed and not wearing professional business outfits. However, in another cover photo which used to be the cover photo, two women who are in professional business outfits were featured (see Figure 5.5).

Figure 5.4. SWE Facebook Page

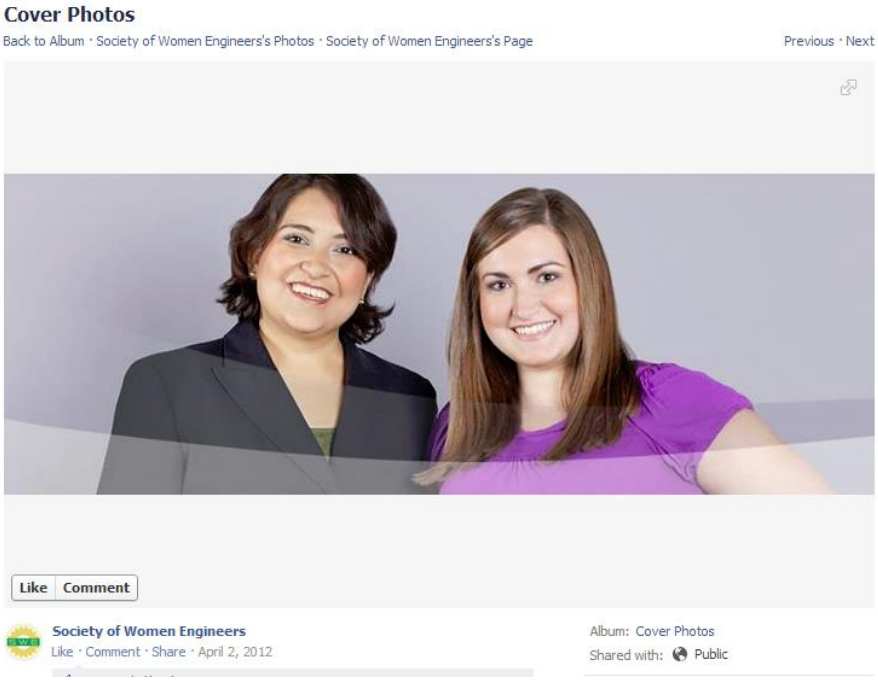

Figure 5.5. SWE Facebook page old cover photo

Second, the SWE Facebook page management team has adopted dialogic communication techniques in managing the Facebook page. Dialogic communication refers to "any negotiated exchange of ideas of opinions" (Kent & Taylor, 1998, p. 325). In other words, instead of simply posting information, the webmaster of the Facebook page also replies to users' comments on the page. These interactions help shaping the personality of the SWE as an organization and personify the online existing of the SWE. In other words, it is worth taking into account of the activities of the Facebook page management team because they help shaping the community communication environment. For instance, replying to one of its page followers' comment, "I am in my 40s and preparing for an Engineering degree. What advice do you have for me", the SWE suggested, "Connect with your local SWE section for the support, mentoring and network

you need to succeed". However, this type of informational or commentary responses by the management team were not as common as the the action of "like" – a Facebook feature which allows users to share their interest.

Lastly, the variety kinds of posts available on the SWE Facebook page build up an online community which full of discussion about women in engineering. Posts including news sharing, events promotion, role models recognizing and many more can be found on the Facebook page. Take June 2013 for example, the SWE Facebook page generated a minimum one post to a maximum three posts daily. In addition, a unique strategy has been employed by the Facebook page management team in order to encourage participation of the page followers. For instance, a post like this can be found on the SWE Facebook page, "Tell us how you give back: I volunteer my time to _____ because _____". The blanks were left out on purpose to stimulus responses from the page followers. Because of many of these "fill in the blank" type of posts, individual opinions about being women in engineering is available to access by general public.

The emerging themes in the following section were identified from a thematic analysis of the SWE Facebook page with a close reading of the available and relevant posts. These themes are related to what sorts of things are women in engineering communicating in their daily activities in social media. Five major themes emerged from the thematic analysis of the women engineers' activities on the SWE Facebook. These five themes are: defining women engineers, raising awareness about women in engineering, encouraging more women to join STEM/inspiring the next generation,

promoting gender equality and empowering women, and holiday posts related to themes of being engineers.

Defining Women Engineers

As observed from the Facebook page contents, the discussion about what sort of things define women engineers were largely discussed among the SWE Facebook page followers. It is not surprisingly to find out that sharing opinions about who is woman engineer plays a big role in women engineers' activities on the Facebook page. Many posts have been contributed to address or challenge the stereotypes about being women in engineering. As a fundamental question which ought to be answered when building one's identity, women engineers gave their own interpretation of who are women engineers in their comments to the news and current affairs.

What qualities should a woman engineer have? Who are women engineers? There seemed to be a lack of universal definition of what kind of qualities one has to have in order to become a woman engineer. Answers to these two questions can be very diverse in terms of personal experience. However, clear dichotomous boundaries can be found in describing personal interpretation of who are women engineers. For instance, a post which shared an article about Chelsea Clinton's opinion on urging Hollywood to make movies and television shows about sexy female engineers was responded with very discouraging comments. One comment responded, "Agree that the profile of female STEM role models should be raised. DISAGREE with making them 'sexy'. Does more harm than good. I might be a good engineer but Cameron Diaz I am NOT"; another comment pointed out, "like it isn't already hard enough to succeed at Engineering, we

know have to be SEXY too? I think this is a mistake". Two comments both showed strong dislike emotion about the opinion that being women engineers have to be "sexy".

However, having feminine characteristics as women engineers is not completely out of consideration. As indicated in comments which replied to the post, "In this edition of 'SWE Magazine', readers learned about the importance of hobbies as they help us stay grounded, well-rounded professionals. What hobbies do you enjoy outside of work", one of the comments reported, "I like playing drums, acrylic painting, calligraphy, exercising, baking bread and cookies and cooking international food... and reading!" Some of the hobbies mentioned in this post are considered relatively girly compared to another comment which reported "Wood working" as a hobby outside of work. These two comments are very contrast to each other but both of them received the most "likes" and remained as the top comments to this post at the time of this research.

How women engineers define what engineering is? Challenging the stereotypical perception of what is engineering seemed to be a "responsibility" of women engineers. Many posts on the Facebook page were often worded to ask page followers to share opinions about the insights of working in engineering. For example, a question about creativeness of working in engineering was asked in the post like this, "A misconception about engineering is that it's all facts and figures all the time. In this issue of 'SWE Magazine,' we learned about the creative side of this profession. What's the most creative application of engineering you've worked on?" However, one of the top comments contributed to this post was not exactly related to being creative at work, instead it mentioned, "Mostly politics; the engineering facts and figures are the easy part."

Another top comment was actually more relevant to the original intention of promoting the creativity of working in engineering as it said, “Developing equipments to run food products with different shapes (dinosaurs, boots, bells, chicken, ducks)”. From these different responses, it is evident that working in engineering is not simply dealing with numbers and figures, but there are more to be faced and done.

What are the challenges of being women in engineering? Many of the posts and comments exclusively reported on the experiences (mostly challenging ones) of being women engineers. In many of these responses, the experience of being women in engineering is nothing different than being women in STEM. All barriers of learning and working in science, technology, engineering, and math were seemed to be connected and can be empathized with. In one post, the page followers were asked to share their opinions on a LinkedIn article about what is pushing women out of sciences, “What do you think, is this article representative of what today's engineering grads and students are experiencing?” Challenges and obstacles are always accompanying women in engineering, how they treat or react to these challenges and obstacles can be seen as their negotiation of their own identities. Like one of the comments mentioned:

> I have found 'the boys club/good 'ole boy network' environment in places I have worked and where I went to university. I ignored it as toxic rubbish and find ways to work around it. ... I also think that we need to teach our female elementary and middle school students that STEM helps people in a positive way; has significant impact to the daily lives of people (think teachers, nurses, doctors, etc.); teach them

> self-esteem, self-worth, self-confidence; and that math is just like any other problem in life.

Another comment pointed out an important debate about whether or not doing engineering should be considered as practicing male characteristics, like being competitive, “honestly I'm a little torn about which problem needs fixed... mean STEM educators who make the field competitive, or a culture that tells girls we just shouldn't be competitive.” Likewise, a comment also suggested how females and males are treated differently in STEM:

> Taking a step back to see how others are commenting on the article paints a realistic picture of how women in STEM are often treated. I must say I am extremely lucky to work on a team with many female engineers and supportive male engineer counterparts. I think it's critical that all STEM majors find a support network to prevent becoming a dropout and survive in the field. Whether people want to admit it or not the world of STEM is completely different for males vs females.

In sum, the experience of dealing with challenges which women have to face when they are working in engineering also constitute a part of who are women engineers.

Raising Awareness about Women in Engineering

As indicated in previous studies, many women in engineering found they are facing the challenges alone since other women who are in the same situation can be hard to find and recognized. Setting up role models, providing opportunities for women in engineering to be acknowledged is urging a supporting network to be built. In the same vein, the primary function of social media is to provide online space for network building.

Based on the Facebook page activities, there are two major tendencies in raising awareness of women in engineering: promoting and recognizing achievement of the others, and encouraging individuals to affirm their own achievement.

Promoting and recognizing achievement of the others. This represents a very common type of posts on the SWE Facebook page. Posts that expressed congratulations to local chapters for their successful events holding are considered regular content on the Facebook page. Additionally, congratulations to scholarship winners, identifying award winning women engineers, or promoting innovation created by women in engineering are also popular to this online community. For example, a post sharing a national news story about women engineers who making impact on automotive manufacturing received a total of 267 "likes". Likewise, a post which received 387 "likes" talked about, "Introduce a Girl to Engineering Day is dedicated to the memory of Sally Ride, who was the first American woman in space. Thank you, Dr. Ride, for bravely blazing a path for women." Nevertheless, well-recognized successful women in engineering are not the only ones who have been receiving compliments. For instance, individual member of the SWE has also been selected to share their stories of striving for success in engineering. A post similar to this theme can often be found on the Facebook page, "What an inspiring story! Learn more about how SWE Region G member Catalina achieved success on her terms, overcoming challenges to become the first person in her family to graduate from college as well as high school."

Affirming personal achievement. Another popular strategy of raising awareness of women in engineering is through getting individual involved. Sharing their own

achievements, these individuals are able to connect to one another and become supportive to one another. Responding to the post, "Wow, we're already halfway through 2013! How are you doing on your goals for this year? What have you accomplished so far", the Facebook page followers provided several positive comments. For instance, one replied, "I am halfway through my awesome summer internship working on a pipeline out in the desert of New Mexico." Another similar comment stated:

> So far, I can say that 2013 is one of the best years of my life ☺ I received the engineering ring, passed the EIT exam, and I am currently doing an internship (my first chemical engineering internship) at the Mosaic company. I finished all of my classes and I will be graduating in August of this year. Spring 2013 was the most difficult semester in my undergraduate journey, but I am glad that I was able to accomplish my goals: I learned so much from my classes and the projects I worked on, especially the plant-design course, I got straights As in all my classes, and I received the honor of being placed on the Dean's list ☺ (Emoticon original displayed).

Beside comments contributing from college level users, comments from retired women engineers help bringing in a historical perspective in recognizing personal achievement. Replying the same post, a Facebook page follower stated, "As a retired Chem E I'm practicing my new career as author with Factory ROMANCE. Honing my skills to write memoir for how Title NINE changed my life." All kinds of activities of raising awareness of women in engineering are certainly a reflection of the unique culture of this online community. In addition to building an online community, the mutual recognition process helps these women in engineering find a support network.

Encouraging more women to join STEM/Inspiring the Next Generation

Raising awareness of women in engineering certainly is importantly, but question still remains as how to get women into the field of engineering and STEM. Moreover, how to attract more young women and retain them in STEM has been an issue which many institutions and organizations are trying to address. Without doubt that this issue has become a driven force behind many posts on the Facebook page. Posts sharing events information, scholarship opportunities, professional development advice, and quotes from famous people are being incorporated together to help addressing this issue. More importantly, these posts and comments are trying to offer solutions to fix this problem. For example, a post stated, "Many members of our leadership are in Austin for U.S. News STEM Solutions where Mayim Bialik is wowing crowds. The Big Bang Theory actress is also a vocal advocate for women in STEM" had received 139 "likes" at the time of this research.

Sharing articles which convey message about encouraging next generation to join STEM is also common on the Facebook page. Posts asking page followers to share insights, advice and life lessons for future generation are always popular among followers. In many cases, future generation is specifically referring to daughters. For instance, a post sharing a project about a mother use her daughter as a model to recreate several famous women portraits draw 82 "likes" because the post stated, "What an inspiring project and message: 'Let's set aside the Barbie dolls and the Disney princesses for just a moment, and let's show our girls the REAL women they can be'."

Likewise, a post shared, “Wonderful words of wisdom from a woman in STEM: ‘Don't be afraid of hard work. Nothing worthwhile comes easily. Don't let others discourage you or tell you that you can't do it. In my day I was told women didn't go into chemistry. I saw no reason why we couldn't. -Gertrude B. Elion Biochemist, Nobel Laureate (1918-1999)” has received a total of 110 “likes” by the Facebook page followers. The message of “you can be anything you wanted to be” speaks for many women in engineering and has been considered as a very important piece of life advice.

Besides life lessons, mentoring and giving career advice are also common topics among the posts on the Facebook page. For mentoring post, the following example summed it the best of how to inspire the next generation with the question, “What are you doing today to inspire the next generation to be that engineer” along with a dynamic graphic posted (see Figure 5.6).

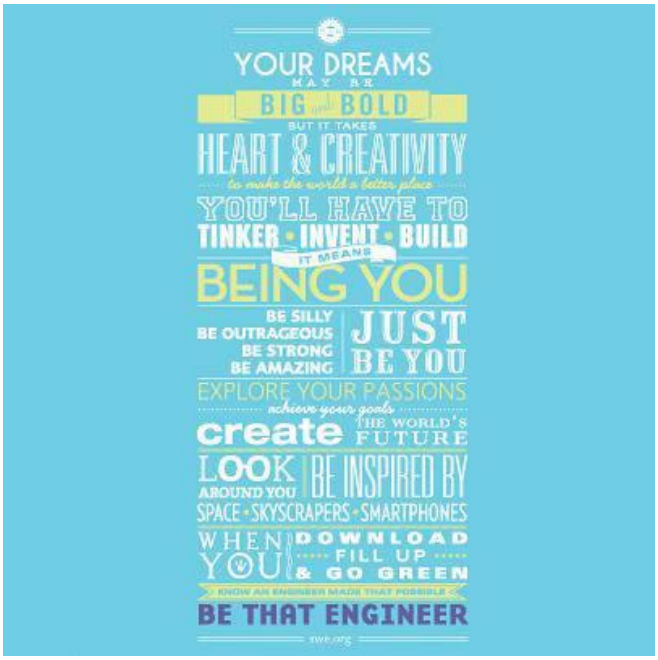

Figure 5.6.Inspiring the next generation

Top comments from the respondents included: “Creating a Television Show to inspire young girls to dream to be an engineer, scientist, computer guru and researcher!” and “I'm buying supplies to do a straw rocket contest at work on Friday with junior high school students. It's Take Our Daughters and Sons to Work day at NGC in Redondo Beach!”

Another post which asked followers to share important life lessons to the next generation received several more “serious” and realistic responses from the followers. For instance, one of the respondents said:

> In the course of your career you will encounter men that will never respect your contribution or treat you as an equal (or accept you a[s] a superior). But not ALL men. And not always from the places and spaces you expect. Don't let them change your goals. But listen to their critiques and see if there is a grain of feedback you can use.

While another comment shared the idea that it is important to know what you want by stating:

> Take the time to figure out what YOU want, not society, not your parents, not your friends, not your significant other, but you. Reevaluate this often because it will change. Then move heaven and earth to go get what you want.

Advice about improving working relationships, tips about finding jobs and what should be done upon graduation is another set of common topics which have been frequently appeared on the SWE Facebook page.

Promoting Gender Equality and Empowering Women

Not surprisingly that posts about promoting gender equality and empowering women can be found on the Facebook page since gender issues have been affecting women in engineering largely. Interestingly, a post about Hillary Clinton has sparked a total of 429 comments, 9, 445 “likes” and 8, 199 “shares” among the Facebook page followers (see Figure 5.7). The post simply stated, “Don't let anyone else limit what you can do just because of your gender.” However, a graphic was also attached with this post with text saying, “Hillary Clinton wrote to NASA as a child inquiring how to become an astronaut. NASA replied that girls could not be astronauts. So she became Secretary of State.” There are three types of responses to this post, some say she gave up her dream because of her gender, some still admire her, some say “This picture doesn't say that Clinton dreamed of being an astronaut - but even with a setback in one area, she achieved success in another male dominated field”.

Not surprisingly that becoming astronauts is another one of popular topics among the Facebook page posts, especially when the audience is women engineers. Another post used astronauts as the theme sent out a message like this, “Congratulations to the 2013 NASA Astronaut Candidate Class! We're excited to see four fantastic women serving as role models for the next generation. Dream big and reach for the stars!”

Figure 5.7. Hillary Clinton meme

Posts mentioned management of work and family, and flexible working hours are also quite common on the Facebook page. When responding to the post which referred to a letter to a female applicant for their City Planning Department in 1961 about how to handle work and family, mix responses can be found as one of the comments stated, “Wow ... We've come a ways since then... But there's plenty of room to grow still” while another comment mentioned:

> I'm sorry, but he wasn't exactly wrong. He was part of the problem, however, instead of attempting to be part of the solution to bring about needed change. The Europeans are way ahead of the U.S. in addressing these ongoing issues.

Fashion and dress code topics are not as common as other career advice posts on the Facebook page. However, one post particularly talked about, “What do you think, is it

sexist to include details about a public official's attire, or just thorough reporting?" The comments for this question are actually quite different, as one mentioned that, "It's sexist until stories just as routinely report on male politicians' navy blue Brooks Brothers suits, blue-and-white striped shirts with contrasting white collars and cuffs, repp ties, and classic black brogues." But on the other end of spectrum, one of the comments responded:

> Absolutely not! As a student engineer, I am so happy to see the plethora of femininely dressed women at my internship. It is refreshing to see that we are being more fully accepted in "nontraditional" careers and that this acceptance no longer necessitates dressing/behaving like one of the boys. If anything, the implied assumption that fashion sense detracts from competency leans sexist.

Catching up the trend of women leadership, it is unsurprisingly to see posts about women and leadership skills appeared on the Facebook page. Just like other professional women might have explored the challenges of balancing leadership and being bossy, women engineers also share their opinions on this issue. The post which shared Sheryl Sandberg's quote, "I want every girl who's told she's bossy to be told instead she has leadership skills" received 658 "likes" from the Facebook page followers. Among the total of 33 comments, one of the top comments said, "There's a big difference between being bossy and being a leader. People don't want to follow someone who's bossy, but they'll go to the ends of the earth for a true leader." More directly coincided with the quote, another comment shared, "I was called a "Bitch" while my male counterparts were "Leaders". Ya know I was okay with that because I believed in myself."

Holiday Posts Related to Themes of Being Engineers

The last theme of common posts and sharing on the SWE Facebook page related to special days and holidays. This type of posts help revealing another side of being women engineers as they are sharing the most intimate experience from their memories. For instance, responding to the post, "In honor of Father's Day, what's the most important lesson you learned from your dad?" Top comments included, "Nightmares about quantum mechanics occur long after college ends", "That I could be anything I wanted to be, including an engineer". There are almost 40 comments in total in responding to this post and again the very popular theme is "I can do anything I wanted to do". In contrast to Father's Day post, post on Mother's Day asked, "In honor of Mother's Day: My mom inspires me because _____." Not surprisingly, top comments from responses mentioned, "Because she is an engineer and never gives up until she completes what she is pursuing! I love my mommy."

RQ3: What are women engineers' perceptions of using social media?

An analysis of an online survey results is included to answer the third research questions and intended to fill in the gaps of the thematic analysis so that the experience of women engineers in social media can be fully captured. In this section, I will summarize and present the survey results as they demonstrated women engineers' individual opinions about social media. I will also use the online survey results to constitute the common themes emerged from the thematic analysis and then provide answers to research questions about whether women engineers are using social media for emotion support or identity communication. Based on the survey results, most of the women

engineers own Facebook, LinkedIn accounts, they use social media mostly for information sharing and obtaining but not for emotional bonding.

For the survey results reported in this section, all percentages are reported based on total responses collected for individual questions. When answering the survey, participants were allowed to skip questions in order to encourage them to participate.

A total of 405 female members of the Society of Women Engineers participated in the online survey. Demographic information will be first provided here to give a background understanding of the participants. As shown in Table 5.1, almost half of the survey participants were from the age group 21 to 30. As indicated in Table 5.2, 76% of the respondents described themselves as White/Caucasian for ethnicity. The next biggest ethnicity group responded to this survey was Asian / Pacific Islander with 12.8%. As indicated in Table 5.3, American citizen were the largest group of participants who took the survey. Among these participants, as demonstrated in Table 5.4, about 40% of them owned a bachelor degree and about 30% of them owned a master degree. Lastly, in terms current occupations, as indicated in Table 5.5, over a half of the participant are current employed as engineers and about 30% of the participants are students.

Age	Response Percent	Response Count
0 - 20	15.7%	52
21 - 30	45.8%	152
31 - 40	19.6%	65
41 - 50	11.1%	37
51 - 60	6.6%	22
61- 100	1.2%	4
		Total: 332

Table 5.1. Age group of participants

Race and Ethnicity	Response Percent	Response Count
American Indian or Alaskan Native	0.5%	2
Asian / Pacific Islander	12.8%	51
Black or African American	4.8%	19
Hispanic American	6.0%	24
White / Caucasian	76.0%	304
Other (please specify)		5
		Total: 400

Table 5.2. Race and Ethnicity

Nationality	Response Percent	Response Count
USA	80.8%	303
UK	0.8%	3
Mexican	1.1%	4
Italy	2.4%	9
China	0.8%	3
Canada	0.8%	3
German	2.1%	8
India	3.7%	14
Other	7.5%	28
		Total: 375

Table 5.3. Nationality

Degree	Response Percent	Response Count
Less than high school degree	0.0%	0
High school degree or equivalent (e.g., GED)	5.7%	23
Some college but no degree	23.9%	97
Trade/technical/vocational training	0.0%	0
Associate degree	1.2%	5
Bachelor degree	37.2%	151
Master degree	27.3%	111
Professional degree	0.5%	2
Doctorate degree	4.2%	17
		Total: 406

Table 5.4. Degree

Current Occupation	Response Percent	Response Count
Employed	66.4%	263
Student	27.8%	110
Intern	5.8%	23
		Total: 396

Table 5.5. Current Occupation

As indicated in Figure 5.8, among these participants, Facebook is considered the most commonly owned social media account with over 90% of participants reported they have Facebook accounts. LinkedIn was reported to be the second most common social media accounts which owned by almost 80% of participants. While Twitter was reported to account for a little bit over 35% of participants' ownership of social media accounts. Other social media accounts own by participants include Goodreads, Instagram, Google+, Tumblr, Pinterest, etc.

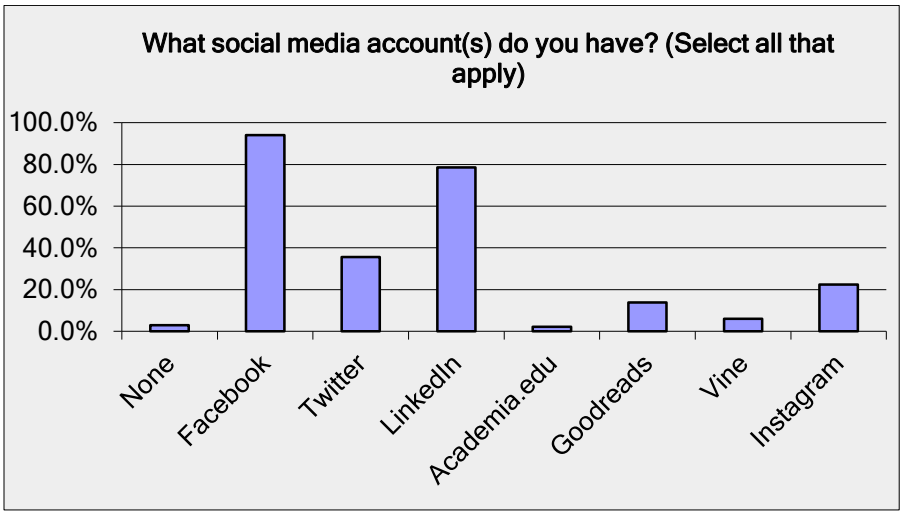

Figure 5.8. Social media account(s) ownerships

In responding to the open-ended question, "If you have social media account(s), what is your motivation to have it (them) in the first place? In addition, what are your

expectations?" Responses such as, I use social media "to keep up with friends and for networking," or "communication / share ideas / networking. I'd expect to have some value from my participation such as keeping up with my network, get information important to me, express and communicate my opinions and get feedback" were very common among the participants. In addition, many reported use LinkedIn only for "getting my name and company out in the prof world". However, explaining the motivation for having a LinkedIn account, one participant responded, "I have no idea why I joined. I guess because everyone else has joined. I don't use it at all. and have an empty profile." Another participant mentioned that, "I made the LinkedIn account because one of my professors required it as an assignment, but I have yet to use it." Moreover, many reported to have Twitter accounts but no use it that much. Overall, the motivation of having social media accounts can be as simple as "because all my friends have them" or the participants want to keep connected with their friends. In many cases, participants reported they "have to have" these social media accounts because of the "peer pressure". For the expectation of using social media, this one participant's response may have expressed most people's belief, "I don't utilize it much and have no real expectations from my participation." Privacy was also mentioned by several participants as one of them stated, "I expect my accounts to make it easy to connect with others and also maintain my privacy well."

When answering whether or not they are current members of any online professional networking and discussion groups, 46. 3% reported they are current members of these groups while 53.7% reported they are not. Many of them reported to be

members of professional networking groups on LinkedIn. However, as shown in Figure 5.9, over a half of the responded participants reported they have not been involved with these online professional networking groups.

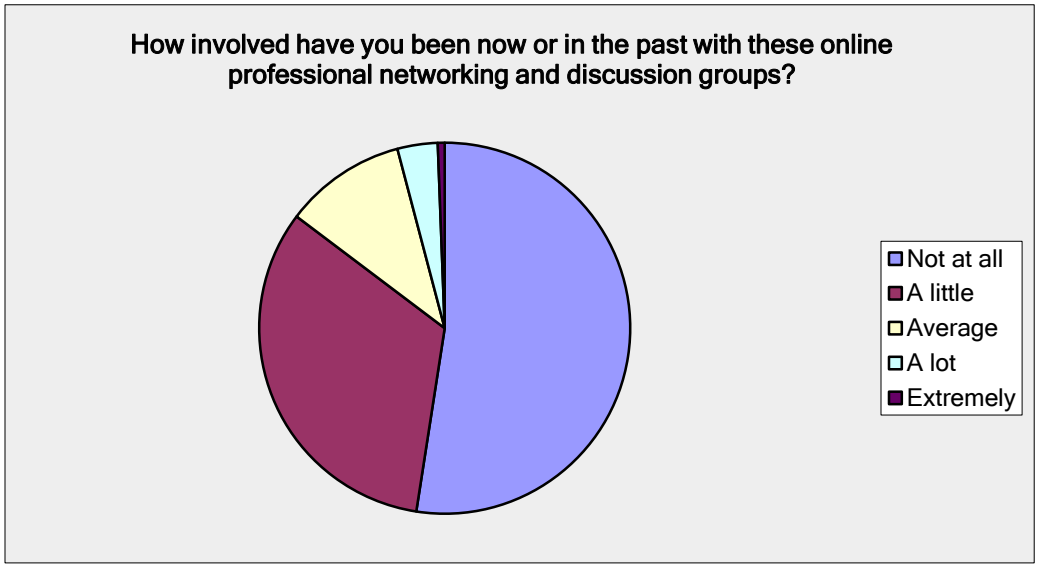

Figure 5.9. Involvement with professional networking and discussion groups

In terms of using social media for mentoring, as indicated in Figure 5.10, 62.6% reported they do not use social media for mentoring, while 28.9% of participants indicated that they use a little for mentoring. For those of participants who use social media for mentoring, as shown in Figure 5.11, Facebook and LinkedIn are still the popular choices over other social media platforms.

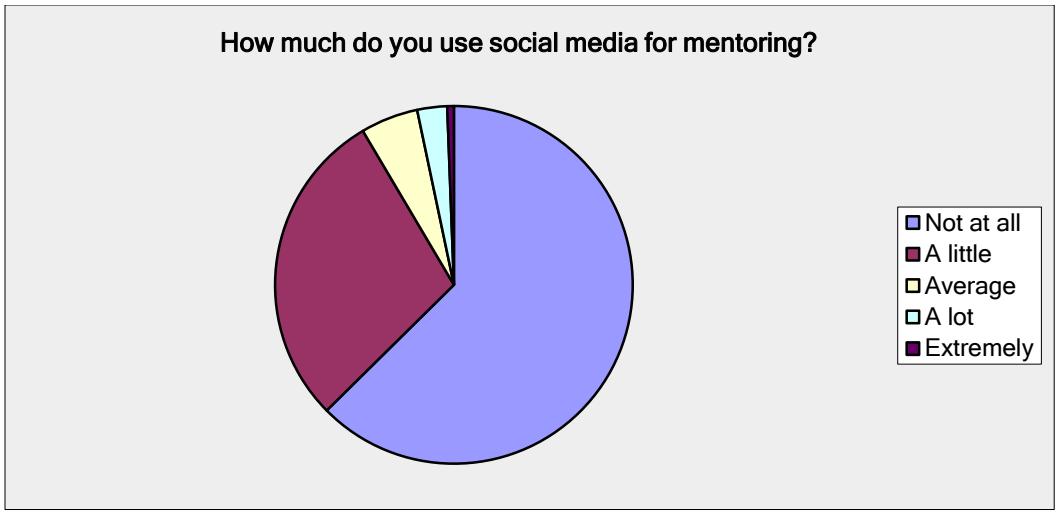

Figure 5.10. Social media for mentoring

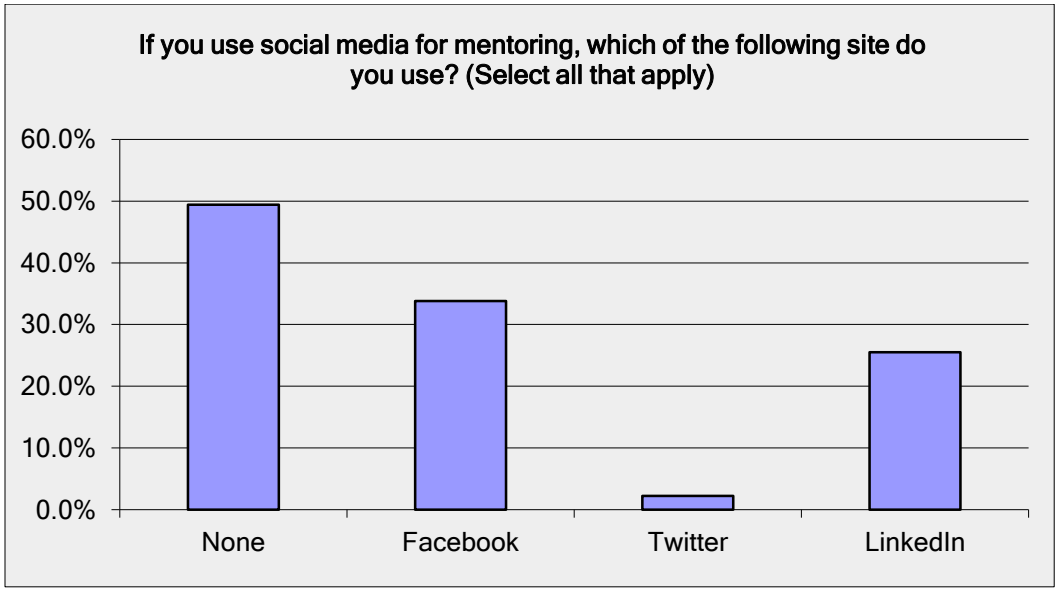

Figure 5.11. Social media sites for mentoring

Among the answers of reporting the perceived advantages of using social media by the participants, “time flexibility”, “accessibility of it”, “quick & easy communication”, “networking” and “visibility” were common to be mentioned. Moreover, someone pointed out that, “many people out there willing to share their

knowledge and give advice." Likewise, another participant suggested, "For mentoring, the benefit is the accessibility and general widespread common use. My mentees tend to use Facebook a lot, so it's a convenient way to engage them." On the other hand, for mentees, one commented:

> For mentoring: it becomes an informal way to quickly communicate with my mentors. I can send a short question, update, or reply in a less formal medium than email without becoming too intrusive on their personal time by texting them. There is less pressure to get my message perfect for sending out, more like a one on one interaction with a mentor.

Nevertheless, some people are fan of traditional way of communication. For instance, one mentioned, "In my opinion, there are zero benefits/advantages of using social media. Nothing compares to face to face communication." Similar responses such as considered social media as "informal communication", or "Being "friends" with someone on facebook doesn't mean much of anything" can be found in the responses. Moreover, one of the participants stated:

> It's a low impact/low committment way to reach out to people and build a network. It works especially well for introverts. My personal feeling is that it creates a more level playing field, in that your personal characteristics can be secondary to the content that you create.

As shown in Figure 5.12, when sharing opinions about their overall satisfaction of being members of the online professional networking and discussion groups, 38.8% of participants reported they are overall about average satisfied with these groups, while

28.8% of participants reported they are not satisfied with these groups. For opinions about developing mentoring relationships using social media, as indicated in Figure 5.13, 61.6% of the participants reported that do not feel more comfortable developing mentoring relationships using social media than developing traditional face-to-face mentoring relationships.

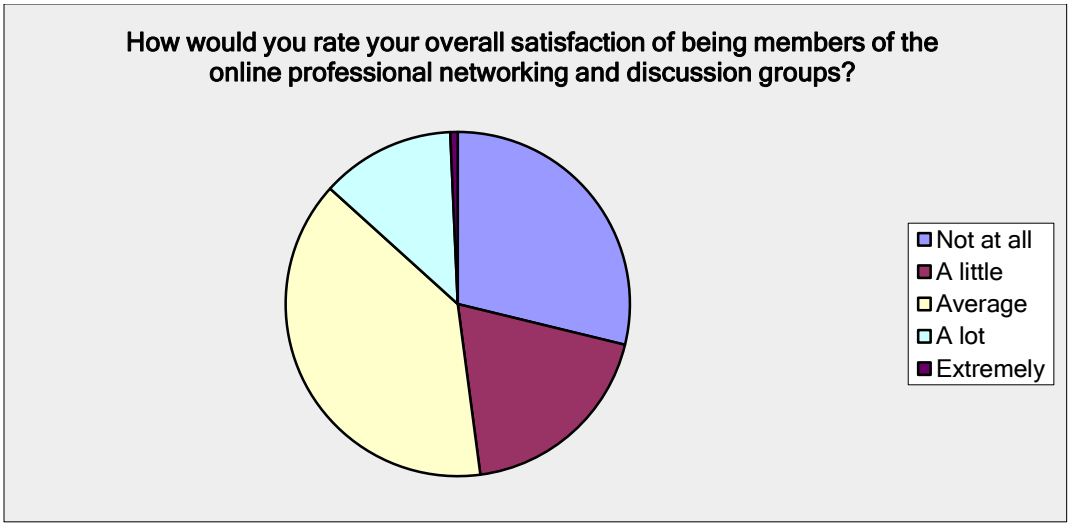

Figure 5.12. Satisfaction of online professional networking and discussion groups

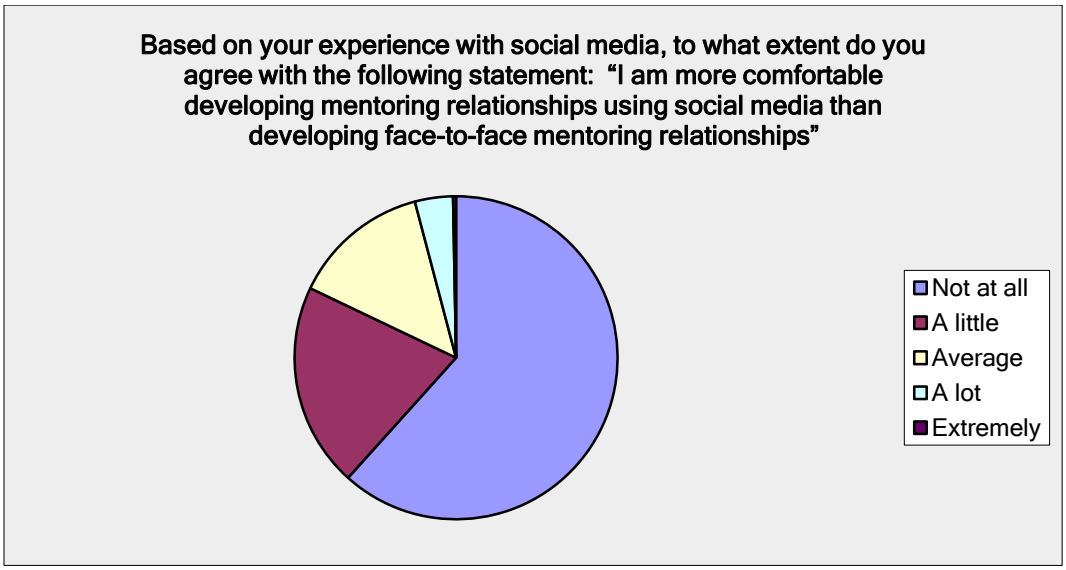

Figure 5.13. Comfortable level of devleoping mentoring relationships using socia media

As shown in Figure 5.14, when referring to their own experience with social media, 31.4% of participants agreed that that they feel like they know a little more women who are facing the challenges of being women engineers, while 28.6% of the participants reported that they do not feel like they agree with the statement. Likewise, as indicated in Figure 5.15, 39.8% of the participants do not feel like they can get more emotional support when using social media, and 31% of participants reported they are a little agree that they can get more emotional support.

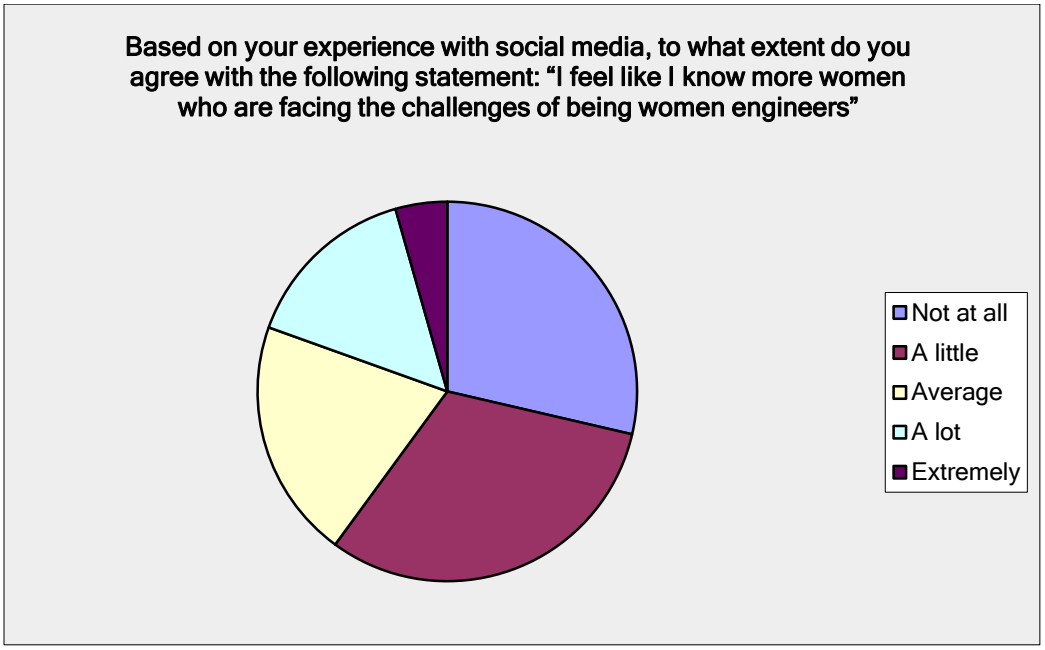

Figure 5.14. Know more women who are facing the challenges

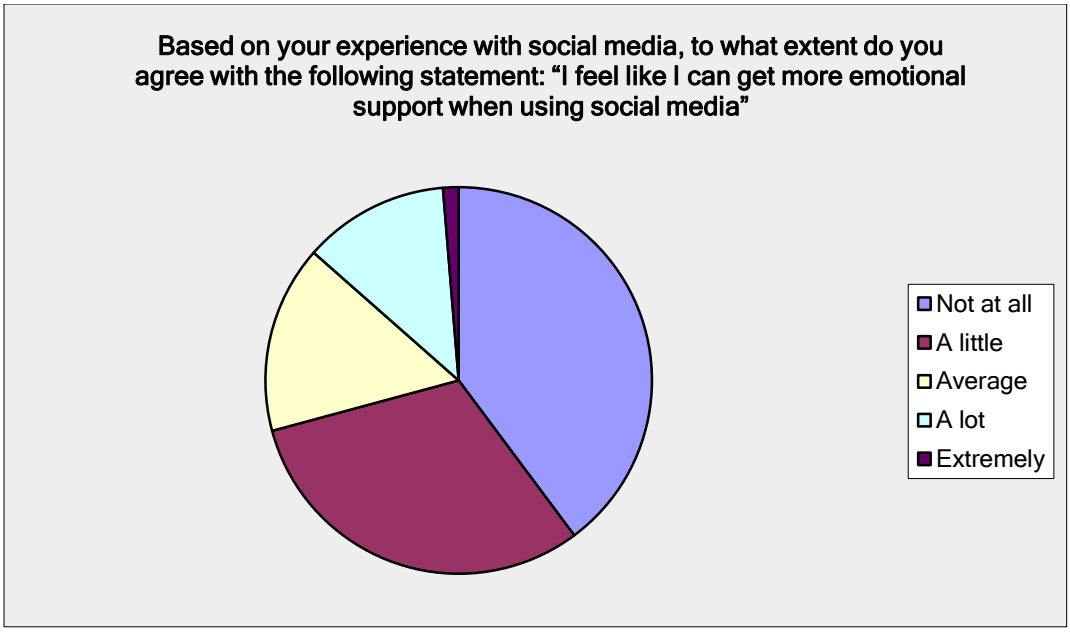

Figure 5.15. Emotional support

Reported by the participants, challenges of using social media included, "consistency with participation", "Many people tend to overshare", "need/desire to also protect my privacy", "information being misunderstood", "not face to face communication", "Saying no to friend requests on Facebook for work colleagues", "disconnecting", "making time for it", "too many choices, a little overwhelming to keep up with them all". One comment by a participant described the best the concern of many women engineers, "I purposefully do not use social media for anything related to my profession because I do not want to be judged or known for what I so outside of work." Likewise, another participant revealed that:

> When people are having trouble with anything, it is much more difficult to talk about it on a social media site than face to face. I am very picky about who I connect with through Facebook. I may talk about something I'm having problems

with but probably not in great detail. I think in general, people are emotionally supportive but it is still media and not people directly that you are dealing with.

Another similar response also noted, "I find it challenging when social media supplants traditional and direct forms of communication. I would prefer to use social media to organize a meeting or event in order to have face-to-face meetings." Most importantly, someone pointed out that the challenge of using social media laid between professional life and personal life, as the comment stated:

> The balance of professional life and personal life grows much more difficult with social media. There are things, not necessarily negative, that you want to keep separate, but social media seems to mesh everything and confuse what is professional vs. what is personal.

Similarly, a participant responded with the concerns about how to be professional online, "Deciding how to present myself, acquiring a professional picture, etc." While on the other side of the spectrum, someone mentioned, "When trying to expand your network on linkedin, people do not respond to introductions or mentorship questions. There seems to not be a great way to establish new relationships online. Several of my friends feel this same way."

As shown in Figure 5.16, when answering "how much does social media help the participants deal with the challenges of being a woman in engineering", 42.1% of participants reported that social media help a little while 36.2% reported that social media does not help at all. However, as interestingly indicated in Figure 5.17, 31.6% of the participants reported they feel like social media offer a little help for them to obtain

professional development information. Although many people reported to have LinkedIn accounts and use LinkedIn for professional networking, as reported by in Figure 5.17, only 38.6% of the participants thought that social media provides a little help for them to develop new professional/mentoring/personal relationships. As for maintaining the newly developed relationships, as indicated in Figure 5.19, 33.4% of participants reported that social media offers a little help. Lastly, reported in Figure 5.20, 29.8% of participants indicated social media does an average job in helping them to maintain pre-existing relationships. However, it is important to note that about similar percentage of participant feel like social media either offers a lot of help or offers a little help in maintaining pre-existing relationships.

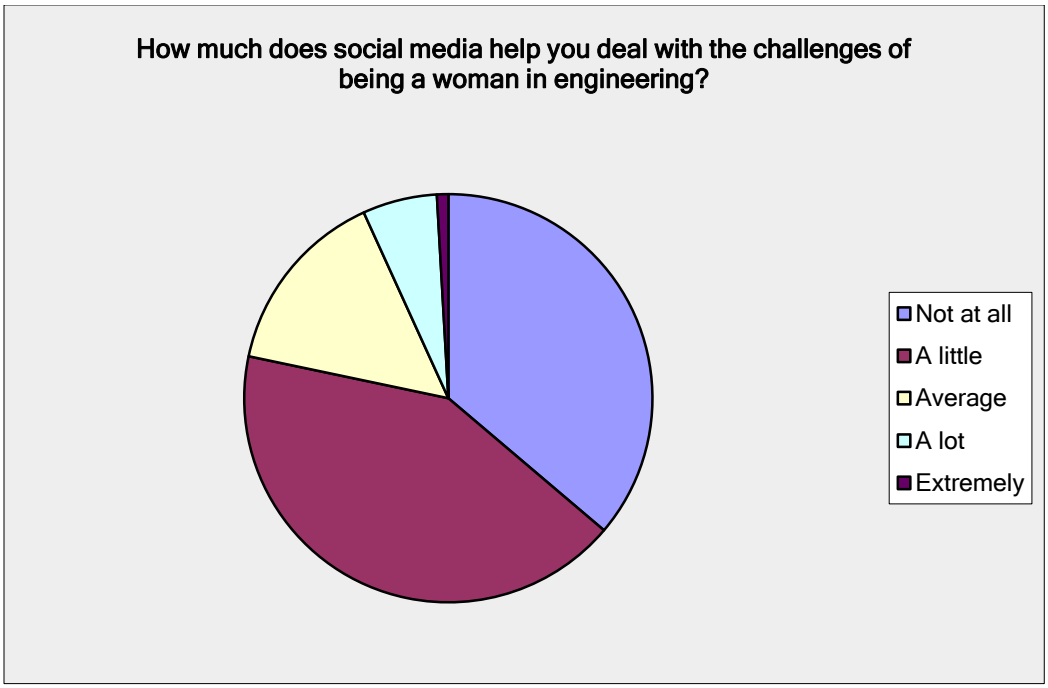

Figure 5.16. Social media and challenges

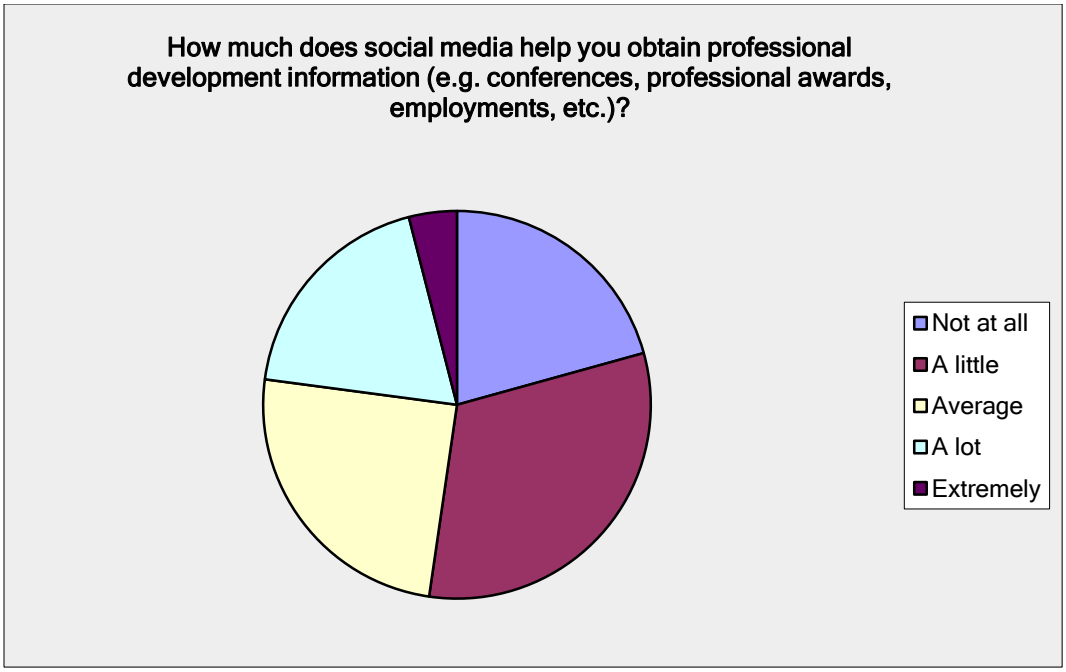

Figure 5.17. Social media and professional development information

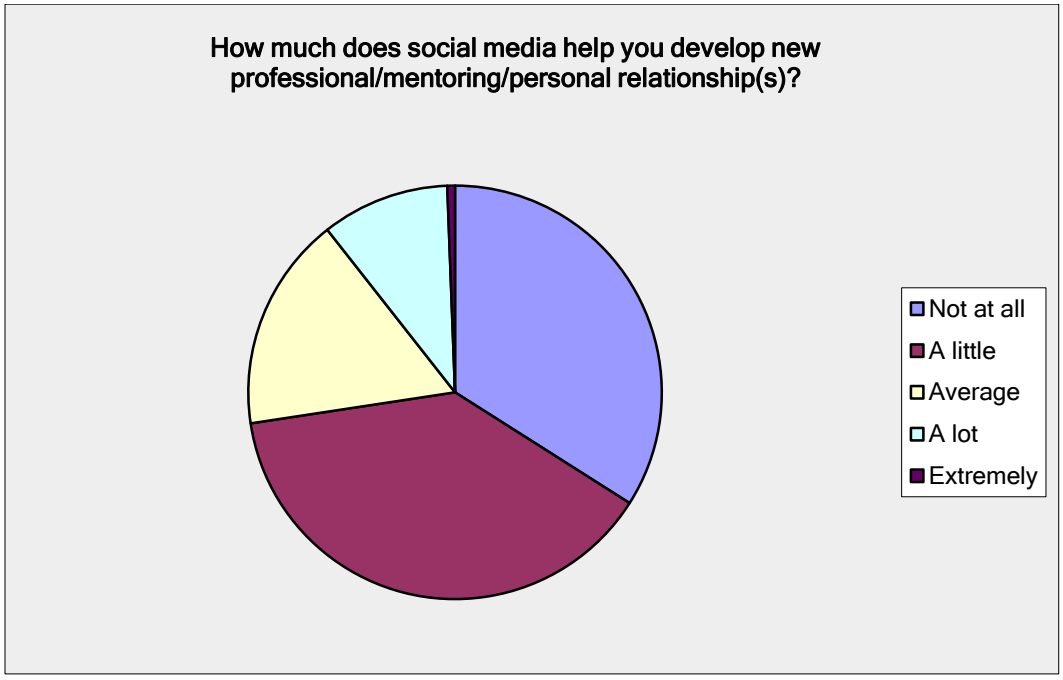

Figure 5.18. Social media and new relationships

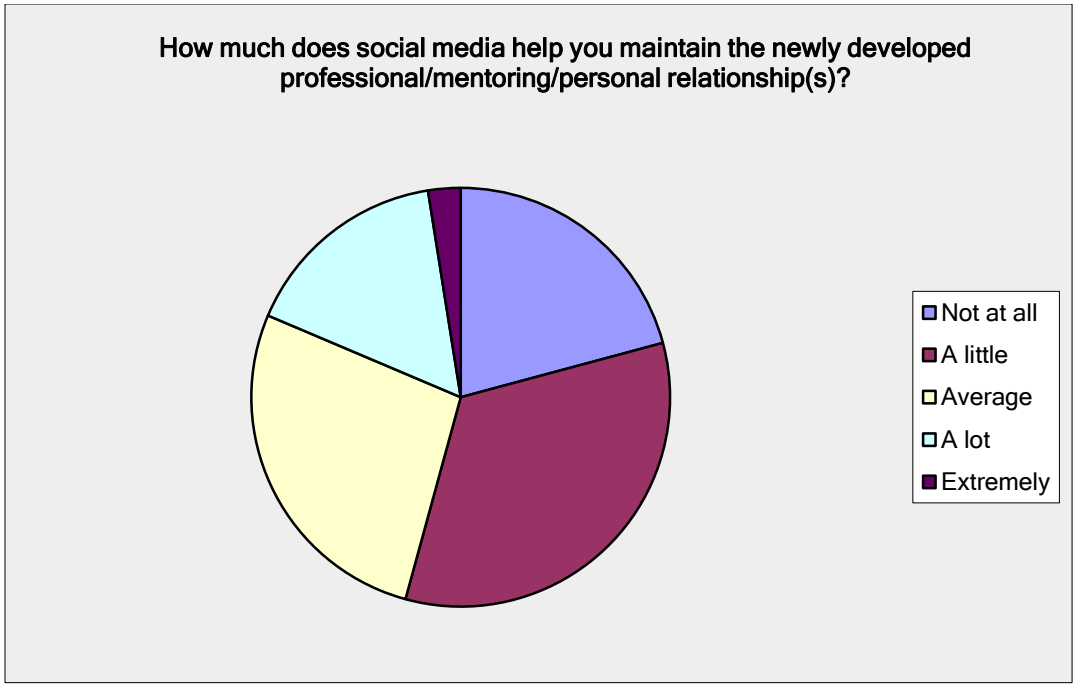

Figure 5.19. Social media and maintaining new relationships

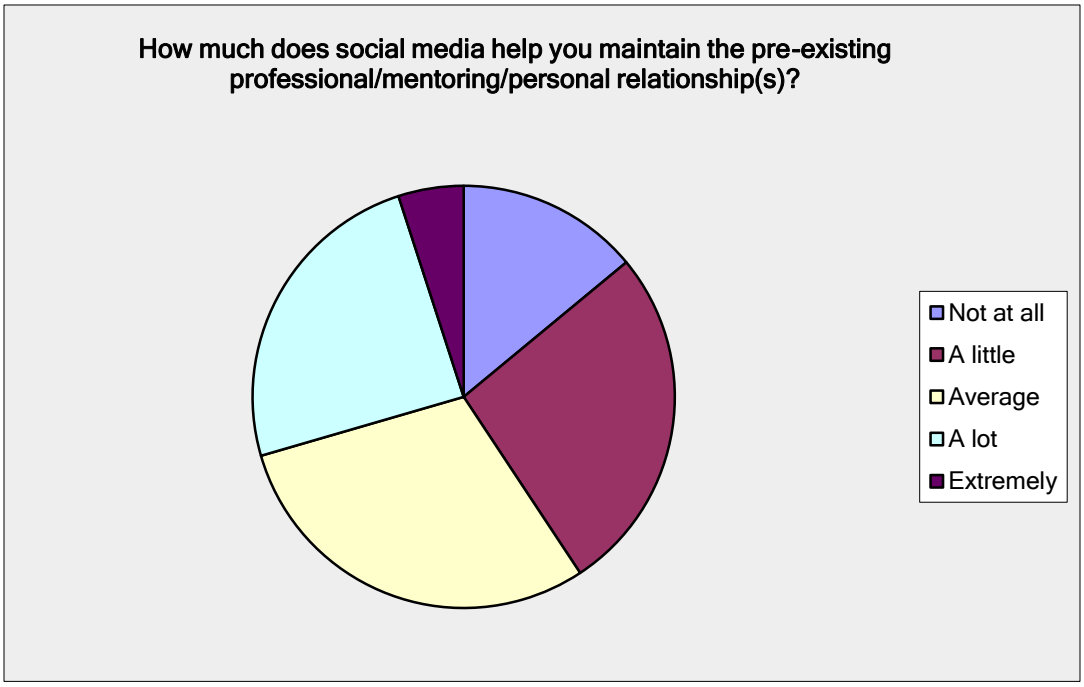

Figure 5.20. Social media and pre-existing relationship maintenance

CHAPTER SIX

ANALYSIS

In this chapter, detailed interpretations of key findings are presented based on the order in which research questions were asked. In addition, an interpretive, feminist approach is used for analyzing these key findings and reconstructing the social media experience of women engineers. The feminist perspective is applied throughout the analysis by first acknowledging the issue of differences, second, valuing the situated knowledge and partial perspectives, and third, allowing reflexive exploration of the findings. The three research questions will be answered by data collected from observations of websites, the SWE Facebook page thematic analysis, and the online survey. Together, these three layers of analysis will inform each other and provide an understanding of women engineers' experience of social media, and how social media facilitate their communication of identity.

Choosing the social media

The first research question, "Which social media are women engineers using?" aims to find out what kinds of social media platforms are women engineers using. The findings from the initial observation of online presence of women engineers' organizations suggest that Facebook, LinkedIn and Twitter are the most popular social media platforms that women engineers' organizations are using. As for individual usage, survey results indicate that over 90% of respondents report that they own a Facebook account, and almost 80% report that they own a LinkedIn account, while only a little more than 30% report they have a Twitter account. In terms of the overall composition of

social media accounts ownership, there is no clear distinction that can be found between how professional organizations are using social media and how individuals are using social media. As expected, Facebook is the number one choice of social media for many of the women engineers. LinkedIn as a professional networking site also attracts many users. The composition of social media accounts ownership matches the findings of Pew Internet Project on Social Networking, in which it reports that 67% of online adult users use Facebook (Brenner, 2013). Whereas being the most famous instant information sharing platform, Twitter is not as popular as the other two social media platforms. It is also important to note that information on Facebook, LinkedIn and Twitter is sometimes flowing back and forth from one another. In other words, similar posts can be found on all these three platforms, and content is often shared on all three platforms.

Facebook. Base on the website observation, it is very common for organizations, especially non-profit organizations like SWE, WIE and WEPAN, to have Facebook pages or Facebook groups. Online presence almost becomes a necessity when these organizations are trying to reach out to potential members and maintain relationships with their current members. It is important to note that although both Facebook page and Facebook group have similar function in terms of providing an online community for people with shared interests, a Facebook page and a Facebook group is not exactly the same especially when it comes to privacy settings. Many local chapters of SWE have their own Facebook groups but some of them remain as "closed" groups so that only members who have been approved by the group manager can have access to the contents.

In addition, Facebook has been developing from the day it was created. Being a well-known social networking site, a significant amount of users is already actively using Facebook on daily basis. Therefore, building an online community using Facebook page only requires Facebook users to "like" the page. Joining a Facebook page or a Facebook group is becoming as simple as clicking a button. This simple and effortless way of joining a community becomes one of the reasons that a lot of Facebook users are part of the Facebook page community. However, these seemingly effortless Facebook activities also create potential drawbacks. For example, some of the women engineers reported that they were concerned about setting boundaries between professional and personal relationships. A more detailed discussion on boundaries setting of professional and personal relationships will be in a later section.

LinkedIn. As the second most popular social media accounts owned by women engineers, LinkedIn distinguishes itself from Facebook with a service for professional network building and maintaining. Nevertheless, some women engineers consider joining LinkedIn is merely for having an online version of their nice resumes so that other potential employers can easily get access to it. Some of the women engineers point out that it is very time consuming to keep all the information up-to-date on LinkedIn. Based on the website observation, the LinkedIn group activities were far less active than activities on the Facebook page. It is also possible that users are intentionally keeping LinkedIn as a *professional networking* site. Thus, they feel they need to be professional and behave professional accordingly. Soon-to-be graduate students and already employed women engineers may have different opinions on the purpose of maintaining their

LinkedIn accounts. It is not unanticipated to see that some well-known industry leaders have more than 500 connections on their LinkedIn pages. However, is this like having 500 friends on Facebook? In addition, the delayed responses or unintentional ignorance of requests asking to be connected on LinkedIn sometimes create misunderstanding among LinkedIn users.

Twitter. For many organizations, Twitter is a popular choice for broadcasting live events. Whereas many women engineers report that they only use Twitter to follow persons or topics they are interested in. Some others report that they have Twitter accounts but do not use it that much. As a micro blogging platform, Twitter serves for instant information sharing. However, as more and more information is flowing into one's Twitter account, information can easily get overloaded. In this respect, digging out important information requires much more time and effort. Not to mention that many social media platforms provide similar services, and these overlapping services are causing users to spend more time and effort to filter out the important information.

In sum, women engineers are using social media just like other online adult users having been doing. All the reasons for making choices over different types of social media reveal that personal preferences and peer pressure both contribute to the decision of adopting social media.

Participating in social media

The second research question, "How do women engineers use social media?" examines activities women engineers have been engaging in using social media. More specifically, a sub set of questions was proposed to examine whether women engineers

were using social media for social support or they were using social media for identity communication.

As revealed by the survey results, women engineers report that they have been using social media for different purposes. For Facebook, many report that using it for stay in touch with family and friends. For LinkedIn, many of them indicate that having accounts so that they are available in the professional world. Lastly, reported by women engineers, Twitter is only for information sharing and interests exploring. However, even though many of these women engineers owned more than one social media accounts, some of them do not have "real" or high expectations for using social media. In other words, they do not wish to get something really important out of these online relationships. Overall, the use of social media only remains beneficial for exchanging of information but not establishing a deeper level of emotional bonding or solving existing challenges faced by women engineers.

In order to present a more situated understanding of how women engineers are using social media, I will provide detailed interpretation of the common themes emerged from the thematic analysis of the SWE Facebook page and then substantiate my interpretation by supporting statements retrieved from survey results.

Five major themes emerged from conducting a thematic analysis of the women engineers' activities on the SWE Facebook. These five themes are: defining women engineers, raising awareness about women in engineering, encouraging more women to join STEM/Inspiring the next generation, promoting gender equality and empowering women, and holiday posts related to themes of being engineers. To further summarize

these five themes, they represent women engineers' experience with identity communication, social support, mentoring and professional development.

Identity Communication. It is very clear that women engineers have engaged in discussion of who are women engineers on the Facebook page. However, based on the data collected from the survey, many participants indicated that they do not get deeply involved with any online activities. In other words, they do not wish to show the "real" self when engaging in online activities.

Although data collected from two sources are showing two different directions in answering the research question, the process of searching for a definition of who are women engineers can certainly be seen as an intersectional experience. For example, when determining the qualities of women engineers, some report that a woman engineer should have both feminine characteristics and masculine characteristics. Moreover, many of them believe that having feminine characteristics will help them do a better job at work. For instance, according to the Facebook page discussion, being creative or having other hobbies outside of work is highly appreciated by many women engineers. However, extreme demonstration of femininity, like being sexy, is strongly opposed by some of these women engineers. It seems like women engineers prefer to be treated based on their intellectuality but not how they look like. For example, one of the survey participants said that she was not happy because someone praised her based on the photos she posted on Facebook but she preferred not to be treated on how she looked on the outside.

The qualities a woman engineer should have also reflect women engineers' definition of what engineering is. Moreover, the definitions of engineering and engineers

are mutually shaping each other in the process of doing engineering and becoming an engineer. Due to the fact that engineering culture has been largely shaped by males, women engineers are making their effort and contribution to reshape the culture of engineering by adding their understanding of engineering and their own practice of being engineers. Additionally, adding their own flavor into the practice of engineering can also considered their solution for solving the underrepresentation of women in engineering. When adopting different strategies to manage the challenges, some women engineers said that they have to work extra hard than their male counterparts to gain respect, while some of them contend that asking for help is important to survive in this profession. Apparently, the coping strategies are very different for individuals who are facing the same challenges. Depending on their own experience, these women do not adopt a universal strategy to react to the challenges.

The other major theme of promoting gender equality and empowering women can also be considered as the strategy women engineers employed to negotiate their identities. Gender issues always go hand in hand with the challenges which women engineers are facing. As an inseparable part that has been affecting women's experience in engineering, gender issues have no doubt turn out to be the hot topic among the Facebook page discussion. For instance, discussion was absolutely on fire in a post about Hillary Clinton. Despite the different personal opinions about Hillary Clinton's political accomplishments, the popularity of this post demonstrated that women engineers care about women's right, and they concern about what does being a woman means in this society. In their opinions, gaining equal rights for women means perhaps one day no more being treated differently

as women in engineering. The victory of women is therefore a victory of women engineers.

Social Support. Another research question asks, "Are women engineers using social media for social support?" The answer to this question is yes. Indicated by the survey result that many women engineers do not get emotional support nor do they feel like they know more women who are facing the challenges of being women engineers from using social media. However, the activities on the SWE Facebook page show that Facebook page followers are in fact actively participating in activities which allow them to encourage one another.

Facebook page activities focusing on raising awareness about women in engineering often attract certain amount of page followers. For example, a post about historical iconic women engineers or a post about scholarship announcement can always obtain a large number of "likes" from the followers. Collectively, these posts on one hand setting up role models for women who are interested in pursuing career in engineering and on the other hand sending out messages to let women who are already working in this profession know that they are not alone. For instance, many posts on the Facebook page encourage individual users to share their plans of the year or goals at work. These sharing experiences consistently contribute to the process of fostering a strong sense of community. As indicated in previous studies, women in engineering often feel like they are fighting this battle alone because they know no one else who are in the same situation. In this way, the use of social media certainly opens up communication channels for

women in engineering to establish an online network in which they can get support from others despite of the geographical differences and time difference.

Confronting ambivalence of being women in engineering is never an easy undertaking; it requires continuing reaffirming of the achievement from self and others. Social media provide a space for some of these women engineers to achieve a sense of belonging. In addition, social media allows women engineers who had same interests to build a network with one another. However, it is important to note that ensuring the longevity of this network needs huge amount a time and energy. Not to mention that many of the women engineers at this point consider this network is only useful for information exchange but not social support.

Mentoring the Next Generation. Mentoring advice is extraordinarily a very popular topic among the SWE Facebook page discussion. The posts are often constructed in a way that page followers were asked to think back and dig into the past to participate in the discussion. For example, one of the posts asked a question about experience of women engineers' first job. It is unexpected to me that how active these women engineers can be when talking about their personal experience and giving advice to the others. It appeared to me that they like to give advice, they want to give advice, and they love to share life lessons to others who wanted to go in the same careers. These women engineers love to talk about the "what if" part of their life. Maybe it is safer to talk about what had been done in the past because in that way the current situation would not be judged by other people and everyone can always be helpful.

However, based on the survey results, women engineers report that they do not engage in mentoring activities when using social media. Many of them report that they may use social media for mentoring but only if they have in person relationships with the individuals. Social media undoubtedly satisfy the immediacy for exchanging information, but intimacy of maintaining relationships is often missing just through exchanging information online. These women engineers love to give advice, but when it comes to establishing real mentoring relationships, they think social media is not serious enough to handle the all the potential challenges that come with mentoring.

Professional Development. Career advice and professional development opportunities are often the initial motivations for organizing a Facebook page. Social media is often considered a good way to get information out to a large audience. On the SWE Facebook page, career advice posts are sometimes related to posts of encouraging the next generation. Many participants of the survey report to have gained a little help from using social media to gain access to professional development information. However, one of the participants said that she missed several important professional development opportunities because they were only published on social media and she didn't have a chance to check that out. Another participant also pointed out that when she was organizing an event, she found it hard to get users to adopt the right type of social media platform to accomplish event registration. The variety features of social media platforms often confused these professional people who are looking for the right kind of information. Relying too much on social media may seem to be risky since information

can easily get lost when there are no appropriate strategies to maintain connections between the users and the information senders.

Perceptions of Using Social Media

The third research questions, "What are women engineers' perceptions of using social media?" focuses on obtaining women engineers' thoughts and concerns on using social media. The findings suggest that most of the women engineers considered they "have to have" social media accounts because everyone else has them and is using them. Many believe that they use social media only because of the peer pressure they got from the others. However, although most of them have social media accounts, the time and effort spent on using these social media account varied. Based on the survey results, women engineers believe both benefits and challenges exist for using social media. The benefits include instant information sharing, accessibility, and stay connected. The challenges are shown as privacy issues, time consuming and information overflow.

Benefits of Using Social Media. Overall, the benefits of using social media support previous studies' findings on how social media are beneficial for exchanging information and maintaining pre-existing relationships. Many survey participants account for their use social media, especially Facebook, as to stay in touch with their friends and family. The ability of allowing instant information sharing helps social media distinguishing itself from the old type of communication methods. Many of the women engineers also mentioned that using social media allow information to quickly get out there to a large audience. For some participants, using social media allow flexibility when it comes to information sharing and responding. As one of the survey participant

mentioned, she would prefer to use social media to ask her mentors some quick questions and not to disturb her mentors with formal ways of communication.

Accessibility is another major benefit of using social media. Social media is easy to use was often mentioned by the survey participants. It is true that with all the cellphone applications available and worldwide accessible internet access, social media can be used at anytime and anywhere. For instance, many organizations have developed social media applications to help attendees stay connected with the newest information updates at conferences. As one of the participant mentioned, social media help her stay in touch with international professionals after attending conferences.

The other benefit of using social media, stays connected, goes hand in hand with the accessibility social media provided. Many survey participants report that they use social media to stay in touch with past co-works. Most importantly, social media provide access to a large professional network. For many professional workers, having access to a large professional network means and getting latest information from the industries means they can stay on top of their game. Getting yourself out there represents this attitude of becoming public available for potential professional networking or development opportunities. Using social media also allows people who have similar interests to stay in touch and exchange ideas. According to one of the participants, using social media allows for brainstorming and innovation.

Challenges of Using Social Media. The survey results also suggest that there are three major challenges of using social media: privacy issues, time consuming and information overflow. Overall, many of the participants think that social media is only for

information exchange and nothing professional or serious would be expected from using social media. As expected, privacy issues become the number one concerns of using social media. Many participants were concerned about what kind of information they should put out there in the social media. The afraid of being judged by other people about the information they have put on social media has become a major concern for these women engineers. More importantly, how potential employers are going to get use of their personal information has made these women engineers pay extra attention about activities on social media. One of the participants even refers to posting information on social media being "dangerous".

Another major concern about using social media is the blurry boundaries between professional and personal lives when it comes to participating in social media activities. This perception reflects the concern of privacy issues since many participants mentioned that they do not want to share about their private lives. It occurred to me that maybe women engineers are being extra caution with their social media activities because they do not want to be perceived as unprofessional by others, especially by their male co-workers. Misinterpretation can often occur when using social media since sometimes information has lost its original context when it got shared by multiple users.

Requiring too much effort to maintain social media status has also been reported as one of the reasons why many women engineers chose not to be frequent users of social media. Some of the participants point out that checking information on social media is time consuming and it has become the last thing they want to do after a full day of work. Information overflow is considered a typical problem when individuals have to manage

multiple social media accounts and are following too much information sources on social media. In addition, overlapping functions on social media has led to even more confusion among its users.

In sum, the findings suggest that using social media allows for immediate informational exchange but lack of intimacy emotional support among women engineers. Since a sense of belonging and community building requires both intimacy and immediacy, the finding also suggest that maintaining an online community which allows for social support requires both immediate information exchange and intimacy relationship bonding.

CHAPTER SEVEN

DISCUSSION AND CONCLUSION

This study aims to examine women engineers' experience in social media with a focus on identity communication. In previous chapters, I presented my research findings, and my analysis of these research findings. I have provided answers to my research questions about women engineers' choices of selecting social media, women engineers' participation with social media, and women engineers' perception of using social media. Combining together, the research findings suggest that social media is widely used by women engineers, and the use social media is mostly for information exchange.

In this chapter, I will provide further discussion on women engineers and social media. Aiming to explore women engineers' use of social media, this study is structured as a case study with a focus to increase general knowledge about women engineers and social media. First, I will compare my research findings to existing literature about women in engineering and contemporary studies of social media. Second, I will use my research experience to offer my understanding of using intersectionality as a concept in research. Third, I will address several limitation of this research and offer suggestion for future research. Lastly, I will discuss and provide recommendations for future practice.

Women in engineering

Previous studies about women in engineering often focus on topics such as: the engineering culture, women in engineering, and being women engineers. For this case study, I focused on women engineers' experience with social media with an emphasis on identity communication. The core issue I examined is about being women in engineering,

but the research setting is slightly different than previous studies as I have looked at the intersection of women engineers and social media. The very first impression I want share is how supportive these women engineers were when I asked for help about my online survey. These women engineers care about women in engineering, they care about studies focus on this issue and they want to offer their help. In a women's leadership class, I learned that women are likely to start their own businesses which aim to help people. Under the impression that women like to help people, it was expected that I would get many responses to my survey. However, it was also unexpected that I could get that many responses. I got over 400 responses to my survey in two weeks. It is quite clear to me that these women engineers have some kind of network which connects them all together and you just have to find the right way to reach out to them.

Based on the thematic analysis of the SWE Facebook page and the survey results, being women in engineering is not always a negative experience and everyone has their own stories. Interestingly, one participant brought up an issue about whether it is an advantages or disadvantage of being women in engineering. She stated:

> At one of my engineering internships, I've also had a boss come out and directly tell me that he only hired me because I was the only attractive female that he interviewed. Why is it, that if one of my male counterparts tells someone their profession, its elicits no reaction, but when I do, people are shocked?

Then she offered her own explanation of why being women in engineering is an advantage:

> Every day, as a woman in engineering, I'm fighting to get the people I work with to think that I am smart and to respect me, and since they are all men, this is much harder for me to do than if I were a man. It's unfortunate, but it's the truth. But I guess by having to do this, it makes me that much better of an engineer, so that's the advantage.

In her statement, this women engineer used her personal experience to demonstrate how she struggled and finally was able to consider being women in engineering is an advantage to her. Another comment from a woman engineer offered a different understanding of why is an advantage of being women in engineering, "I feel accepted and even at an advantage as a woman engineer...people remember us easily since we are few." Maybe some of the women engineers would strongly opposed this kind of opinion because it seems like people who are doing this take a short cut to being engineers. However, people holding this understanding are not unusual. I was told by an African American young lady from one of my classes that she got hired at an engineering company because she is a woman and an African American. Nevertheless, who is to decide what is right or what is wrong? In my opinion, as long as you put in your time and effort to try to be the best you can, you can be proud of who you are.

Since many of the women engineers considered social media is not a professional channel for communication, many still believe that face-to-face is the most effective way of communication. When it comes to the problem of lack of role models, I believe many of these women engineers are hoping that a TV show can be created to address the underrepresentation of women in engineering. Not enough public exposure and public

recognition are still considered to be major problems that yet to be solved. The old school mass media is still considered to be the most effective way of communication when it comes to raising awareness. One of the SWE Facebook posts was about an actress showing up at an event and supporting women in STEM. The actress portrays a woman scientist in a popular TV show called "The Big Bang Theory" and she actually has a Ph.D. degree in her real life. Despite the fact that her character in the TV show is still a stereotypical woman scientist who is smart but socially awkward; it is quite interesting to see that the post about her actually drew a lot of attention on the Facebook page. In terms of offering solution to get more young girls into engineering and science, one of the survey participants offered her own thoughts:

> …the more time I spend on social media talking to professional women about the challenges, the more irritated I get. I don't see women taking action…. Pick whatever phrase you want, 'Master of Your Own Destiny', 'Taking The Road Less Traveled', or 'Leaning In but women would be much better off in STEM if we just all learned to speak up, take on the leadership required, and change through action.

Nevertheless, it is hard for me to determine whether or not women engineers take enough initiation to actually work on improving the current situation. Indeed they address the problem, and offer solutions when they talk about these issues in social media. But based on the survey results, if many of them truly believe that social media is only for fun, it may need longer time for real action to be happened.

As indicated in literature reviews, gender issues are very important when addressing the culture of engineering and challenges of being women in engineering. Yet, it is still quite interesting to me when I found out significant events like "Take your daughters to work" and "Title Nine" also have a great impact on women engineers' experience. Promoting women's rights and empowering women are beneficial to every women no matter they are engineers or not. In this respect, a great advance for women can also be a great advance for women in engineering.

Lastly, based on the observation on the Facebook page, the use of metaphors by some of the women engineers has displayed a tendency to dichotomize the experience of being women engineers. LEGO and Barbie are two opposing metaphors often used in the Facebook page discussion. It almost seems like playing LEGO is equal to the practice of engineering, while playing Barbie equal to girly activities that has nothing to do with engineering. It also shows that girls who play Barbie only pay attention to a person's beauty on the outside but not the inside. However, some women engineers also suggested that LEGO is not enough for girls who are interested in engineering, a new type of toy which suits for these girls' needs needed to be invented. Astronaut is another word that has a deeper meaning base on the Facebook page discussion. It appeared to me that many women engineers considered being astronaut as a great honor and a great recognition of success. The meaning behind the word is that if men can go outside of the earth and explore the universe, so can women. Another example of application of dichotomy is that one of the posts on the SWE Facebook page used the following quotes from Annie Oakley:

> Aim at a high mark and you will hit it. No, not the first time, nor the second and maybe not the third. But keep on aiming and keep on shooting for only practice will make you perfect. Finally, you'll hit the Bull's Eye of Success.

Also attached a photo of Annie Oakley with a gun (see figure 6.1). Is that means only being "manly" enough – can shoot a gun – can a girl be a woman engineer? I personally found it quite interesting since my friend who is also a woman engineer post a picture of her holding a gun on Facebook. Maybe the preference of demonstrating the ability to perform the traditionally defined men's job can help establishing the confidence of being women in engineering.

Figure 7.1. Annie Oakley

Social media

As indicated in the survey results, for women engineers, the type of social media matters when they are trying to engage communication with others. Facebook becomes the number one choice for these women engineers because the motivation of using social media is often simply just to stay in touch with family and close friends. However, the advantages of using social media can also turn into the disadvantages. When it comes to addressing a problem that requires more than information exchange, social media is not the first choice among these women engineers. The power of face-to-face communication can never be easily diminished. It seems like social media has the ability to reach the surface of the problem but it becomes harder for social media to break through the surface and go underneath to connect people with real bonds.

Moreover, because many activities on social media are largely depend on the platform's availability, therefore information and connections can easily get lost due to the changes caused by the platforms. For instance, if Facebook change features or user interface display, users may have to alter their user habits to readjust to the new features. The time and effort required to catch up with the changes often keeps people like women engineers – who are too busy being professionals at work – from becoming loyal users of these social media platforms. Consistent engagement and participation is the key to the longevity of an online community. Therefore, if changes are happening too fast, whether or not the users can readjust themselves becomes the key to maintain a community culture.

Additionally, one of the survey participants mentioned that in her opinion, there is an age gap with social media usage. Another participant also reported that she received no response after sending out a networking invitation has made her reluctant to reach out to more professionals. Disconnected from the others is among one of the concerns when women engineers are using social media. Sometimes these disconnections may happen because many professional people only have accounts out there but never update them. When young professionals reach out to old professional and received no response can often lead to unnecessary misunderstanding and create more problems.

Intersectionality

For this case study, I used intersectionality as a theoretical framework to guide my understanding of women engineers' experience with social media. The concept of intersectionality provides a unique lens to examine any given situation with an emphasis on acknowledging the issue of differences. Individual differences have been valued in this research since they offer a more complex understanding of the research questions. Based on the research findings, some of the women engineers prefer to be treated as just another man at work, but some of them enjoy being the minority in a male-dominated profession because of their own experience of learning to be women engineers. In addition, the employment of intersectionality also allows me to incorporate my own experience which I obtained from working with women engineers to interpret the findings.

When applying the concept of intersectionality to interpret women engineers' experience, I came to the conclusion that everyone has their own coping strategies to

react to the challenges of being women in engineering. There is no universal right or wrong way to be a woman engineer. When applying intersectionality to explain women engineers' social media activities, it leads me to a new set of problems. For instance, is social media providing a platform to negotiate intersectionality, or is it actually enlarging the dilemma of choosing one identity over another? On the one hand, social media allows sharing of information and opinions so that women engineers are no longer isolated by their own experience but free to explore other strategies to cope with the challenges. However, on the other hand, women engineers are often force to face some issues when using social media such as balancing boundaries of professional and personal relationships in which they have to perform certain identity over another.

Nevertheless, the lack of practical implication of utilizing the concept of intersectionality does at some levels create confusion for interpretation the data. Intersectionality provides a good analytical lens, but then "so what"? The concept helps interpreting the phenomena, but practical implication was missing. In other words, it is good to address the issue of differences when looking at individual experience, but how to apply this individual experience and generate a significant understanding to apply back to the general public becomes a hard to determine decision. In addition, the concept of intersectionality can only provide limited interpretation in the current study since no specific research questions were designed to address the intersections other than gender and professional identities.

Research Limitation and Future Research Recommendation

This study is frame as a case study, and I used the concept of intersetionality to guide the research. Thus, limitations can be found in my choice of theory, data collecting method, and interpretation and analysis of data. First, based on the survey data, there is a significant lack of diversity among the research participants' ethnicity since most of the participants are White/Caucasian. Minority experience of women engineers such as Asian American, African American, or Hispanic and Latino in women engineers has yet to be fully explored as many of the current studies often focused on White/Caucasian women engineers. For future research, in order to use generate a more profound findings on women engineers' experience, sub sets of questions regarding to particular racial and ethnicity groups' experience should be included to explore intersectional experience of different individuals.

Second, the survey did not design age specific questions to explore how age can affect the use of social media and reflect the concerns of identity expression on social media. Attitude towards using social media might be different among different age groups, especially among in-college students and professionals. Future research needs to address age specific questions so that impact of social media on professional communication can be fully determined.

Third, I used email invitations as recruitment methods for recruiting survey participants. However, based on the current findings, many of these participants considered email as the primary professional form of communication between professionals, and social media is not a serious platform for professionals. Therefore,

these participants' opinion on social media can be potentially biased since they may not be the frequent users of social media. Future research needs to take into account of deciding target audiences for research.

Fourth, due to the method I chose to collect data, there is no follow up questions were asked to clarify the meaning of certain sentences or words. Hence, the interpretation of the data could simply base on my understanding of the words and sentences which would result in misinterpretation. In-depth survey which allows for clarification of the data may be useful in future research. In addition, in order to fully capture individuals' stories and experience of being women in engineering, in-depth interviews and focus groups are considered to be better choices in provoking more valuable findings.

Recommendation for Future Practice

The study provides valuable recommendations about the use of social media by organizations which focus on advancing women engineers. First, trust building should be an important task if organizations want to build an active online community. Trust building also can only be gained through intimacy and emotional bonding among social media users. Only information sharing is not enough to build an online community which aims at creating support network to help women gaining resources to react to the challenges of being women in engineering.

Second, it is important for social media management team to pay attention to the different user behaviors among users at different age groups. To bridge the connection and create potential mentoring community may require more effort than just sending out information. Instead sending out the right information to the right groups is the key in

attracting users from different age groups. Social media is not the only effective way of sending information to a large audience. Solely depends on social media may result in a loss of users from certain age groups.

Third, a good boundary needed to be established for both personal and professional use of social media before intruding personal spaces. To obtain a successfully balance between personal and professional lives on social media may require more than one organization act properly. But overall, setting up a better privacy control may encourage more potential users to join the community.

Lastly, tailored information which is individually situated or target at a specific group of people needs to be created to prevent information overflow. Although social media is often considered good to use for reaching out to a large audience instantly, a nice designed and situated message still have the power to reach out to more people and have a better chance to stand out from the crowd.

APPENDIX

QUESTIONNAIRES OF SURVEY

The purpose of this study is to understand women engineers' experience in social media and how they utilize social media to communicate their identities. To protect your privacy, the survey is anonymous, so please do not put your name anywhere when you are answering the questionnaire. Please respond to the following questions based on your experiences using social media. Omit any questions that do not apply to you.

(Demographic questions here)---

1. What is your gender?
    a. Male
    b. Female
    c. Transgender
    d. Prefer not to respond

2. What is your age? _____

3. What is your Race/Ethnicity?
    a. Asian or Pacific Islander
    b. American Indian/Native American
    c. Black/African American
    d. Hispanic/Latino
    e. White/Caucasian
    f. Other _____

4. What is your nationality? _____

5. What is the highest degree or level of school you have completed?
    a. Some high school
    b. High school graduate
    c. Some college
    d. Trade/technical/vocational training
    e. Associate degree
    f. Bachelor's degree
    g. Master's degree
    h. Professional degree

i. Doctorate degree

6. What is your current occupation? (If possible, please provide your current job title.)
   _____

* Below are a set of questions about social media. In this research study, *social media* is defined as online communities, social networking websites, and internet-based applications which allow users to create, share, and exchange information, ideas, personal messages, and other contents (as photos, videos). [1] Please select the answer that best represents your experience with social media.

7. What social media account(s) do you have? (Select all that apply)
   a. None
   b. Facebook
   c. Twitter
   d. LinkedIn
   e. Academia.edu
   f. Goodreads
   g. Vine
   h. Instagram
   i. Other _____

8. If you have social media account(s), what is your motivation to have it (them) in the first place? In addition, what are your expectations?

9. Are you a current member of any online professional networking and discussion groups?
   a. Yes
   b. No

   If "Yes", please specify the name(s) _____.

10. How involved have you been now or in the past with these online professional networking and discussion groups?
    a. Not at all
    b. A little
    c. Average
    d. A lot

[1] Definition adapted from Merriam-Webster online dictionary and Kaplan and Haenlein (2010).

e. Extremely

11. How much do you use social media for mentoring?
    a. Not at all
    b. A little
    c. Average
    d. A lot
    e. Extremely

12. If you use social media for mentoring, which of the following site do you use? (Select all that apply)
    a. None
    b. Facebook
    c. Twitter
    d. LinkedIn
    e. Other _____

13. In your opinion, what are the benefits/advantages of using social media?

14. How would you rate your overall **satisfaction** of being members of the online professional networking and discussion groups?
    a. Not at all
    b. A little
    c. Average
    d. A lot
    e. Extremely

15. Based on your experience with social media, to what extent do you **agree** with the following statement:
    "I am more comfortable developing mentoring relationships using social media than developing face-to-face mentoring relationships"
    a. Not at all
    b. A little
    c. Average
    d. A lot
    e. Extremely

16. Based on your experience with social media, to what extent do you **agree** with the following statement:
    "I feel like I know more women who are facing the challenges of being women engineers"
    a. Not at all
    b. A little
    c. Average
    d. A lot
    e. Extremely

17. Based on your experience with social media, to what extent do you **agree** with the following statement:
    "I feel like I can get more emotional support when using social media"
    a. Not at all
    b. A little
    c. Average
    d. A lot
    e. Extremely

18. What kind of challenges, if any, have you had when using social media?

19. How much does social media help you deal with the challenges of being a woman in engineering?
    a. Not at all
    b. A little
    c. Average
    d. A lot
    e. Extremely

20. How much does social media help you obtain professional development information (e.g. conferences, professional awards, employments, etc.)?
    a. Not at all
    b. A little
    c. Average
    d. A lot
    e. Extremely

21. How much does social media help you develop **new** professional/mentoring/personal relationship(s)?
    a. Not at all
    b. A little
    c. Average
    d. A lot
    e. Extremely

22. How much does social media help you maintain the newly developed professional/mentoring/personal relationship(s)?
    a. Not at all
    b. A little
    c. Average
    d. A lot
    e. Extremely

23. How much does social media help you maintain the pre-existing professional/mentoring/personal relationship(s)?
    a. Not at all
    b. A little
    c. Average
    d. A lot
    e. Extremely

Please add any additional questions, comments, concerns and/or suggestions about your experiences as a woman in engineering, your use of social media, or anything else you'd like to share with the researchers.

_____

_____

Thank you for your time.

If you have any questions or concerns about this study, or if any problems arise, please contact my thesis study advisor, Dr. Travers Scott at (864) 656-5247 or dscott3@g.clemson.edu, or me, Dongni Wang at (865) 438-4085 or

dongniw@clemson.edu. If you have any questions or concerns about your rights as a research participant, please contact the Clemson University Office of Research Compliance at (864) 656-6460 or irb@clemson.edu. If you are outside of the Upstate South Carolina area, please use the ORC's toll-free number, (866) 297-3071.

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