The Use of Intergroup Dialogue to Address Sexism in STEM Fields:

A Qualitative Investigation

A Dissertation Presented for the

Doctor of Philosophy

Degree

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ABSTRACT

The study examined the experiences of eight participants who partook in an intergroup dialogue (IGD) on gender and sexism in STEM, and the learning that resulted from this experience. Participants consisted of upper-level undergraduate students (junior and senior class rankings) as well as graduate students who were currently obtaining degrees in STEM fields. The study sought to understand how IGD members construct meaning of their experiences as those experiences relate to their understanding of interpersonal and systemic sexism in STEM. Grounded theory was used to code the data and generate categories that were organized into a conceptual framework which centered around one central, all-encompassing explanatory category. A constructivist paradigm was used to analyze the data with a social justice lens. Ultimately, *Perspective-Taking* emerged as the central category with five subcategories: *Personal Barriers, Work Inside and Outside the Group, Critical Consciousness Development, Change in Culture,* and *Ally Development*. Strengths and limitations of the study, as well as clinical implications for future interventions designed to eliminate sexism in STEM are discussed.

Keywords: Intergroup dialogue, gender, STEM, social justice, grounded theory

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CHAPTER I: INTRODUCTION

To optimize the economic and technological productivity required for the United States to remain globally competitive in the modern age, our society must begin to maximize all of its available intellectual resources (Beede et al., 2011). Science, technology, engineering, and math (STEM) fields represent some of the fastest growing, in-demand, and highest paying jobs in the world. Yet, in the United States, women are underrepresented within STEM fields. The underrepresentation of women in STEM begins early in life and progressively increases as women advance though levels of education and careers (Chen, 2013). Despite girls and women showing interest and seeking formal education in STEM, there is a progressive loss of women's presence within STEM positions (e.g., students) and occupations (e.g., full-time, paid careers) this phenomenon is known as the *leaky pipeline* (Dasgupta & Stout, 2014).

The leaky pipeline begins in elementary school and women are lost at each integral transition point along the path of education and career building (e.g., from elementary to high school, from high school to undergraduate, from undergraduate to graduate school, from graduate school to post-doctoral positions, and into obtainment of professional positions; NAS, 2007). For example, disproportionately fewer STEM degrees are awarded to women than men at all levels of collegiate study, including in undergraduate, graduate, and post-graduate work (National Science Foundation, 2017).

The attrition of women from STEM has significant consequences on a global level. STEM jobs increasingly contribute to quality of life, national security, and societal growth all over the world (Beede et al., 2011). Therefore, increasing the number of people employed in STEM is becoming increasingly important. However, women represent a much smaller number

of those employed in STEM, even though they make up roughly half of the population of the United States. This suggests, women are an under-utilized resource in the STEM workforce and a source of potential ideas that could help the United States remain competitive on a global level (Chen, 2013).

Women's attrition from STEM also represents a significant economic loss which has multiple consequences. Women's lack of representation in some of the highest paying STEM fields results in women in STEM earning less than their male counterparts. This loss of potential wages results in cumulative and compounded disadvantage over time for women, which serves to maintain systemic gender oppression (Budig & Hodges, 2010). Second, the funds expended to train an individual in STEM are significant and are ultimately unrecovered if women choose to reinvest their knowledge and skills in other fields (Rosser & Taylor, 2008). In addition to these negative consequences of attrition, the systemic sexism that the leaky pipeline reflects has negative mental health consequences for women (Szymanski, Gupta, Carr, & Stewart, 2009). Given these potential consequences of the attrition of women from STEM fields, it is imperative to understand how we can effectively intervene to address its root causes.

Several concepts associated with systemic sexism have been identified as potential causes for women exiting STEM fields. These include a lack of *sense of belonging*, *gender discrimination*, and *gender stereotyping*. *Sense of belonging* is the sense that one fits in and belongs to a specific community as noted by feeling accepted and valued by one's peers (Good, Rattan, & Dweck, 2012). If these conditions are unmet, an individual may lack a sense of belonging to their respective STEM community. Due to a lack of sense of belonging, women can feel alienated, lose interest, and actively disengage from STEM fields, instead seeking out communities where they feel more valued and accepted (Good et al., 2012). *Gender*

discrimination is differential treatment based on gender, whether of hostile intent or otherwise (Greenwald & Pettigrew, 2014). Gender discrimination occurs at all levels of institutions. For example, gender discrimination in STEM fields can be seen in preferential hiring practices based on gender, regardless of qualifications (Moss-Racusin et al., 2012). Lastly, *gender stereotyping* is the act of passing judgments about the abilities or attributes of individuals based on their perceived gender (Kurtz-Costes, Rowley, Harris-Britt, & Woods, 2008). Gender stereotypes contribute to gender inequity when they have negative impacts on women and not men (Cheryan, Zieglar, Montoya, & Jiang, 2016). For example, a common gender stereotype in STEM is that men are better at math than women. Cumulatively, these experiences contribute to women leaving STEM at much higher rates than men and must be addressed if STEM is to retain women and repair the pipeline.

Efforts are being made to address female attrition in STEM through a variety of means. Federal interventions were implemented to promote girls' interest in STEM in early academia under the Obama administration (Handelsman & Carnival, 2015). Other federal interventions include programs like the National Science Foundation's ADVANCE program, which supports colleges and universities in the promotion of gender equity in academic STEM disciplines through identification of barriers, supports, and opportunities to transform organizational cultures (NSF, 2017). Different interventions focus on increased preparedness and support for women entering STEM, mentoring programs, and increased opportunities for girls and women to be exposed to STEM experiences (Tsui, 2007). However, upon review of current interventions to address gender inequality, there exists few structured interventions that address systems of privilege and oppresion which may lead to problematic gendered cultures within STEM.

Privilege is a phenomenon that occurs when an individual, based on membership to a certain sociocultural identity

has access to a resource which is denied to those outside of that specific sociocultural identity group strictly because of group membership, rather than because of merit, actions, or behaviors (Johnson, 2006).

Many current interventions focus on reparative experiences for women and focus less on addressing gender privilege and systemic forms of gender oppression that exist within STEM cultures. Researchers in STEM have called for interventions that allow opportunities for increased perspective-taking and peer networking (Cheryan et al., 2017; Dasgupta & Stout, 2014), as well as experiences that foster collaborative goals which build a more united community (Diekman et al., 2015). Literature also calls for interventions that involve more systemic approaches to addressing gender inequity and the consciousness-raising of men in STEM about how their beliefs and actions contribute to gender inequality (Robnett, 2016), in efforts to address problematic cultures of systemic sexism and male privilege. We found no intervention in the literature that included the responsibility of men to participate in learning about and being challenged to consider their part in the systemic oppression of their female colleagues.

Additionally, current literature addressing calls for interventions are focused on quantitative outcomes associated with gender equality in STEM, and not what the process of learning about gender oppression/equality is like for individuals. The dearth of literature centered on the meaning making of interventions involving critical consciousness and ally development is problematic. When numerical change on specific constructs is the sole focus of research, the larger picture of why and how change happens may not be clear. The processes of

change are equally important and the outcomes associated with reducing sexism. We must better understand how individuals process these interventions so that we can better predict areas of strength in the interventions and areas where individual resistance may hinder the ultimate goal of critical consciousness and ally development.

The current study proposes the use of intergroup dialogue as a tool to address systems of privilege and oppression that perpetuate gender inequity in STEM. Intergroup dialogue (IGD) is a small group intervention which brings together individuals from social identity groups who share a history of conflict between (e.g., women and men in STEM), for sustained, face-to-face communication (Zúñiga et al., 2007). The goals of IGD include the development of: (a) relationships across groups, (b) a critical social consciousness (i.e., an awareness of hierarchical social systems that perpetuate group-based inequalities, like those that exist within STEM institutions), and (c) capacities to promote social justice (Zúñiga et al., 2007).

IGD outcomes are related to aims found in STEM-intervention literature (Hopkins and Domingue, 2015; Nagda, McCoy, & Barret, 2006; Rodenborg & Huynh, 2006; Zúñiga et al., 2007), including enhanced perspective-taking skills across differing identities (Dessel, 2010; Gurin, Nagda & Lopez, 2004; Hurtado, 2005). IGD has also increased understanding of structural inequalities (Sorensen et al., 2009), like experiences of gender oppression as a result of institutional discrimination. Research on IGD has shown that it challenges stereotypes (Griffin et al., 2012), like those that pervade STEM and negatively impact women (Smith, Lewis, Hawthorne & Hodges, 2012). An additional outcome associated with IGD is an increased commitment to social action (Sorensen et al., 2009), which allows women and, importantly, men to learn about actions they can take to change oppressive STEM cultures.

This study sought to utilize IGD as an intervention that collectively incorporated previously mentioned constructs like sense of belonging, peer contact and support, and critical education about oppressive systems into its process, however the goal was to elucidate what that experience was like for those who are exposed to such an intervention. Using grounded theory methodology (Corbin & Straus, 2008), the study examined IGD participants' experiences learning about power, privilege, and oppression in STEM.. Ultimately, a conceptual framework was created to describe \ processes experienced by IGD group members as they engaged in meaning-making about IGD, that can serve to inform future IGDs and other interventions aimed at reducing gender oppression in STEM.

CHAPTER II: LITERATURE REVIEW

What is the Problem?

The leaky pipeline and gender gap in STEM. Women interested in pursuing degrees and careers in STEM fields are increasingly lost at every educational/career transition point starting in elementary school and continuing into career selection (NSF, 2017). Female attrition in STEM fields contributes to what has been called the "leaky pipeline" (Dasgupta & Stout, 2014). This dropout takes many forms, including but not limited to, women's selection of courses they take in high school (Legewie & DiPrete, 2014), women's selection of college majors that do not match existing STEM interest, women changing from STEM-majors to non-STEM majors during their undergraduate studies, and the pursuit of non-STEM careers following graduation (Blickenstaff, 2005). For example, one review examining motivations for entrance to and attrition from STEM fields found that more women than men left STEM fields or switched to non-STEM majors in both bachelor and associate degree programs (Chen & Soldner, 2013). Those who research the leaky pipeline call for greater efforts to retain women who are already involved in STEM fields and to change the culture that creates the pipeline crisis to begin with (Allen-Ramdial & Campbell, 2014). In order to mend the leaky pipeline, it is first important to intervene to address the systemic sexism and culture of male privilege that pervades STEM.

A disproportionately smaller number of STEM degrees, jobs, and positions are awarded to women than men. In 2014, 57.2% of all bachelor's degrees and 59.9% of master's degrees were awarded to women in STEM (National Science Foundation, 2017). These statistics may be misleading however, given that there are considerable differences in women's enrollment and participation across STEM (Cheryan et al., 2017). Women are entering into and receiving higher

numbers of degrees in certain fields like psychology (women account for 76.7% of bachelor's degrees awarded in psychology) and biological sciences (women account for59.1% of bachelor's degrees awarded in biology), yet women are still vastly underrepresented in other fields such as computer sciences (women account for 18.1% of bachelor's degrees awarded in computer sciences) and engineering (19.8% of bachelor's degrees awarded in engineering).

The numbers of women in STEM fields begins to dramatically decrease as women progress through stages of their careers. For example, in 2014, out of all postdoctoral fellowships awarded at academic institutions, 16,005 were awarded to women compared to 28,618 awarded to men (35.9 % of postdoctoral fellowships awarded to women; NSF, 2017). Even in areas like biological sciences, where women comprise the majority of undergraduate degrees awarded, they were awarded 8,508 postdoctoral fellowships compared to 11,046 postdoctoral fellowships awarded to men (43.5% awarded to women). In engineering, 1,642 postdoctoral fellowships were awarded to women compared to 5,665 to men (22.5% awarded to women). In mathematics and statistics, 195 postdoctoral fellowships were awarded to women compared to 764 men (20.3 % awarded to women). More men were awarded postdoctoral fellowships than women in all STEM fields accept psychology, family and consumer sciences, and other social sciences (e.g., anthropology, linguistics, political science). These differences occur despite women achieving grades and other academic attainments equal to, or beyond, that of their male counterparts (Rosser & Taylor, 2008), intervene to address the systemic sexism and culture of male privilege that pervades STEM. Postdoctoral positions are often gateways to full-time positions in the workforce. Because women are leaving STEM fields at higher rates than men, one result is fewer women occupy senior and leadership positions in the STEM workforce (Rosser & Taylor, 2008).

Women are underrepresented in the STEM workforce beyond just academic positions. In a review of U.S. census data, Landivar (2013) found that, although women's representation in STEM occupations has increased since the 1970s, they are still significantly underrepresented in certain areas of STEM, specifically, engineering and computer sciences. Combined, these career fields compose more than 80% of STEM employment opportunities. Researchers have found reports that men are employed at a 2:1 ratio compared to women in STEM occupations (Landivar, 2013). Additionally, a similar 2:1 ratio exists when looking at science and engineering graduates who are actively in the labor force, with approximately 1 in 10 male science and engineering graduates being out of the labor force (unable to obtain employment despite actively seeking it or having deliberately chosen to seek employment in other fields) compared to approximately 1 in 5 women with the same degrees. These numbers provide insight into women's underrepresentation in STEM and patterns of systemic sexism that privilege men, while disadvantaging women.". The loss of knowledge, training, and skills occurring at crucial transition points comes at a cost in academia and industry jobs related to STEM fields.

Cost of female attrition in STEM. The implications for female attrition in STEM have broad societal, economic, and global implications (Beede et al., 2011; Chen, 2013). Advances in science fuel economic competitiveness, societal growth, quality of life, and national security. As such, growth has been projected in STEM fields. However, the domestic production of professionals able to fill those positions has not met the growing demand forcing domestic companies to search for talent internationally (Beede et al., 2011). To improve its competitiveness on the global stage, the United Sates must be able to meet the growing needs of STEM jobs, which cannot be done without the increased presence of women (Beede et al., 2011). Given that women comprise 50% of the American population and more than 50% of those

bound for college, the underrepresentation of women in both STEM majors and careers signifies an under tapped resource of human capital (Chen, 2013). Women hold close to 50% of all jobs in the U.S. economy, yet they hold less than 25% of STEM jobs (Beede et al., 2011). Of the women who do hold STEM degrees, they are less likely to work in STEM occupations compared to their male counterparts (Beede et al., 2011).

Considering the growing economic potential generated by the growth in STEM jobs, women risk equitable gains relative to men in standards of living, political access, and economic power if they are not equally represented and compensated. Group membership in varying economic classes provides differential access to a society's assets, beliefs, and services. Differential access to these resources are associated with status expectations, location, and power (Lott, 2012). Lott (2012) states that membership in a specific social class "reliably predicts" how much one can obtain and benefit from a society's economic and political resources, where higher class denotes greater access to economic and political resources and therefore greater power within that society. Ideology fostered within specific classes, combined with material conditions including inadequate purchasing power, limited healthcare options, debt, and housing and food insecurities other produce and maintain inequality (Bullock & Lott, 2010). Classism does not exist in a bubble however— one must consider *intersectional oppression* of women in the STEM workforce, where they experience disadvantage due to multiple sources of oppression (Crenshaw, 2014)— both sexism and classism. When considering other varied identities, such as race and sexual orientation, intersectional oppression is further experienced.

Given that access to higher paying jobs (wealth) leads to increased societal power, women who consistently make less money (either due to gendered-wage gaps or lack of representation in higher paying careers, like those in STEM) have less access to resources and

therefore have less societal power. For example, Beede et al. (2011) found that women in STEM jobs earned 33% more than comparable women (equivalent levels of education and degree requirements) in non-STEM jobs. This was significantly higher than men in STEM jobs versus comparable men in non-STEM jobs, suggesting that the gender wage gap is smaller in STEM jobs than in non-STEM jobs. However, according to a study by the National Center for Education Statistics, the highest paying STEM degrees for undergraduates four-years post-graduation are in areas that show the lowest numerical representation of women, including computer and information sciences ($66,000 annually) and engineering and engineering technology ($67,600 annually; Cataldi et al., 2014). This suggests that women are missing out on monetary opportunities, and as a result not achieving the same societal power as men in STEM who occupy higher paying STEM careers/fields.

Female attrition in STEM fields results in massive societal economic costs. Training for STEM degrees involves thousands of hours of training and experience that can be very expensive. This is frequently funded through state and federal taxes, grants, and programs aimed at promoting STEM research (Rosser & Taylor, 2008). Education and training in STEM fields, can therefore be considered an investment of both time and financial resources. So, when individuals chose to leave STEM fields, this can be viewed as loss of investment, given that the skills and expertise of that individual will no longer be utilized in generating new ideas and work. Rosser and Taylor break down this loss further. They conservatively estimated that the individual and institutional economic cost of a STEM Ph.D. is approximately $500,000 (as an in-state resident at a public institution) and that monetary cost grows significantly as on-the-job training and experience are added. They then multiplied that number by 3,000, the number of estimated Ph.D.-trained women who drop out of the STEM workforce every year. Their total

estimated economic loss from attrition of just women with Ph.D.s in STEM fields alone, was approximately $1.5 billion USD per year.

Systemic Sexism: Fueling the Leaky Pipeline?

Risman (2004) argues that the creation of difference is essential in the creation and maintenance of inequality. When individuals and institutions involved in STEM engage in oppressive behaviors like discrimination, gender-stereotyping, and processes that lead to a lack of sense of belonging contribute to the creation of difference in gender in STEM which serves to maintain gender inequality and oppression. Lorber (1994) described that gender is an institution nested within social processes of daily life and social organizations and that the creation of gender difference by societies is predominantly a way in which to justify gender stratification. They also stated that gender difference is socially constructed and simultaneously used to justify social stratifications and unequal distribution of resources across gender. Lorber stated "the continuing purpose of gender as a modern social institution is to construct women as a group to be subordinate to men as a group" (p. 33). Martin (2003) describes certain characteristics and behaviors that social institutions use to propagate social inequality including: distinct social practices; practices that restrict and enhance problematic behaviors and actions; gendered expectations based on rules and norms that are intrinsically sexist in nature; ideas that are internalized as an institutional identity and sense of self in that institution (sense of self as a scientist); practices that are contradictory and promote conflict; and behaviors and ideology that are organized around and structured on power differentials. All of which, directly involve behaviors that influence a lack of sense of belonging, discrimination, sexual stereotypes. The institutional creation of difference through behaviors that influence a lack of sense of belonging,

discrimination, and sexual stereotypes serves to propagate and maintain the systemic oppression of women in STEM fields.

Sense of belonging. One such pattern of individual and systemic sexism contributing to a gender gap in STEM is women's lack of a sense of belonging within the culture of STEM fields. *Sense of belonging* is the feeling that one fits in and belongs to a specific community (Good, Rattan, & Dweck, 2012). It incorporates the view of oneself as included, valued, and accepted by peers within a community, or more specifically, an academic discipline within STEM fields. Good et al. state that when sense of belonging is reduced, or low to begin with, individuals may choose to opt out of the specific domain or field, despite high levels of achievement or interests, to pursue academic or professional goals in different disciplines where they believe there is more opportunity to experience a sense of belonging.

Good et al. (2012) focus specifically on "academic" sense of belonging, and how this specialized experience may impact motivation and achievement. In their research with mathematics majors, they found that students' sense of belonging predicted their desire to pursue math in the future, with a higher sense of belonging leading to greater desire. They found that women's sense of belonging in math predicted both their academic choices and achievement in relation to math. Lastly, women's sense of academic belonging was also related to their perceptions of their academic environments, meaning sense of belonging decreased as women's perceptions of the degree of stereotyping or fixed views of math intelligence increased. Conversely, the more women perceived an environment where their peers view intelligence as malleable, rather than fixed, the more likely they were to maintain a sense of belonging to math even when they perceived their environments as highly gender-stereotyped. Several factors

impacting women's sense of belonging in STEM were prominent in the literature including *perceived energy expenditure*, *numerical representation*, and a *lack of female mentors*.

Perceived energy expenditure. In their work on academic sense of belonging, Smith, Lewis, Hawthorne, and Hodges (2012) investigated how women's self-perceived effort expenditure impacts their sense of belonging and motivation in male-dominated STEM fields. They found that women in STEM graduate programs perceived that they must exert more effort than their male peers to succeed. These feelings were directly related to women's decreased sense of academic belonging to, as well as desire to pursue their field of graduate study. In their further examination of this finding, Smith et al. (2012) found that female undergraduate students considering male-dominated graduate programs demonstrated increased motivation to pursue the field when they were explicitly told that their success was possible through equal expenditures of effort as other students. They found that undergraduate women expressed less interest in pursuing a graduate program in STEM when the course description explicitly stated that the program was male-dominated, compared to women who read a gender-equal course description.

Numerical representation. In STEM classrooms, men typically outnumber women by at least 3 to 1 (Dasgupta & Stout, 2014). Women in STEM classrooms frequently find themselves in the minority, and at times being the sole woman in a class or on a team. Kanter (1977) described how this phenomenon of being a "solo" or "token" individual of an identified sociocultural group, can lead individuals to feel overly visible, cornered by stereotypes of that sociocultural group, and pressured to perform well to represent their particular identity as a whole. Like Smith et al.'s (2012) findings on program descriptions, one study found that undergraduate women in STEM majors indicated a lower expected sense of belonging and interest in attending a conference when they watched a promotional video showing a gender

composition of 3:1 male-female ratio, compared to a video depicting a 1:1 gender ratio (Murphy et al., 2007). Men, in contrast, were unaffected by this difference in their sense of belonging and interest in attending. Smith et al. attributed this difference to stereotype threat, an experience where people believe they might be treated negatively or devalued solely because of their sociocultural identity. Specifically, the authors believed that situational cues in one's environment (like being the sole woman in a classroom) may contribute to steroetype threat-even if those individuals are interested and proven achievers in the relevant domain.

Lack of female mentors. The disproportionate gender representation in STEM fields can be seen and felt beyond the peer ratio in classrooms. Given the disproportionately low number of female supervisors and faculty in STEM positions, women in STEM experience a lack of same-gender mentors and role models. Much literature focuses on the specific lack of female mentors in academic settings, given the low numbers of female STEM faculty (Blickenstaff, 2005). Mentors may positively influence a wide variety of experiences for those under their tutelage including professional and personal development as they advance in their careers (Griffin et al., 2010). The lack of female mentors can result from a myriad of reasons, including female faculty's own lack of sense of belonging within academic departments, biased hiring and promotion practices, and publication gender bias, all of which can be the result of gender discrimination (Blickenstaff, 2005). As such, gender discrimination can be considered another potential cause of female attrition from STEM.

Gender discrimination. Gender discrimination occurs when individuals are treated differently on the basis of their gender, regardless of whether the differential treatment is a result of hostile intent (Greenwald & Pettigrew, 2014). Gender discrimination can manifest in many forms, including differential treatment from supervisors, teachers, loved ones, and others; direct

denial of opportunity in personal, academic, and professional contexts; and the social marginalization of women who enter stereotypically masculine fields (e.g., STEM fields) (Greenwald & Pettigrew, 2014).

One study examining gender bias as a potential cause for the leaky pipeline, assessed whether science faculty members showed preferential evaluation and treatment of male students over female students with equal qualifications. They found that both male and female faculty judged female students as less competent and less worthy of being hired than a male student with identical qualifications, when considering applicants for hypothetical biology, chemistry, and physics lab manager positions (Moss-Racusin et al., 2012). Another study found that male authors' contributions were perceived as possessing greater scientific quality, even when the information presented to raters was matched in content (Knobloch-Westerwick, Glynn, & Huge, 2013). The same study found that male authors fostered greater *collaborative interest,* the creation of interpersonal connections, when they worked on male-typed topics such as science and mathematics, whereas females were not seen to foster such collaborative interest in the same male-typed topics. The myriad of discriminatory behaviors and attitudes may be due to pervasive, harmful gender-stereotypes.

Gender stereotyping. Stereotypes are judgments about abilities or attributes based on membership to a certain group or categorization (Kurtz-Costes, Rowley, Harris-Britt, & Woods, 2008). Common stereotypes of associated with STEM fields include, but are not limited to, ideas about the people who perform STEM work, perceptions of potential, the type of work involved, how valuable STEM fields are viewed, and ideas about family/work balance (Cheryan, Zieglar, Montoya, & Jiang, 2017). According to Cheryan et al., gender stereotypes have the potential to contribute to gender inequality if they have differing impacts on women than men, or

if men and women hold different stereotypes either way, stereotypes can be influential even if they are inaccurate.

Gender stereotypes have the power to encourage or discourage students and employees from making choices that match with proscribed gender roles in society group (Kurtz-Costes, et al., 2008; Wang & Degol, 2013). For example, Cheryan (2012) found that although women are performing comparably to men in mathematics classes, it is still viewed as a gender role "violation" for women to pursue actual careers in mathematics, suggesting that gender stereotypes related to mathematics likely serve as a barrier to the recruitment of women into mathematics careers.

A long-held gender stereotype is that STEM fields are masculine fields (Dasgupta & Stout, 2014; Nosek, Banaji & Greenwald, 2002). For example, computer scientists, engineers, and mathematicians are perceived as stereotypically male professions (Cheryan, Plaut, Handron, & Hudson, 2013; Nosek, Banaji, & Greenwald, 2002). Nosek, Banaji, and Greenwald (2002) found that consideration of group membership (being female), group identity (self = female), and gender stereotypes (math = male) were related to attitudes and identification with mathematics and other science fields. Women with stronger stereotypes of math as a masculine field possessed more negative math attitudes and weaker math/science identity, whereas men with stronger "math = male" stereotypes were associated with more positive math attitudes and stronger math identity. Individuals who held stronger stereotypes of "math = male" showed more negative implicit and explicit math attitudes for women. This finding was present even in female participants who had self-selected math-intensive majors, meaning that even women who select math and science fields hold gendered stereotypes about their chosen field, in which their own identify as female is discordant with how they perceive their field.

Relatedly, commonly held stereotypes suggest that women are commonly valued according to qualities not considered to be desirable for STEM fields (Diekman et al., 2010). Some examples of these commonly stereotyped qualities include interpersonal effectiveness, egalitarian values, linguistic emphasis, social skills, and altruism (Cech, 2013; Cheryan, 2012; Nosek, Banaji, & Greenwald, 2002), which are not commonly associated with STEM fields, whereas qualities that are stereotypically aligned with STEM (e.g., a drive for power, social isolation, and being technology focus; Cech, 2013; Steele, 2003) deter women more than men from STEM fields. Research suggests this occurs because those stereotypes are deemed incompatible with the way women self-conceptualize and would like to be conceptualized by others (e.g., emotional, unsystematic, or people-oriented self-conceptions; Cech, 2013). Stereotypes such as these potentially explain why there is a discrepancy in gender representation across STEM fields where such qualities might be construed as more desirable (e.g., psychology, biology, and medicine; Cheryan, 2012). Upon further examination of the stereotype of STEM as "male," Cundiff, Vescio, Loken, and Lo (2013) found that undergraduate women in introductory science courses including biology, physics, and chemistry, who held stronger implicit male-science associations identified less with science and had weaker science career aspirations than those with weaker male-science associations. Nosek, Banaji, and Greenwald (2002) suggest that this occurs as a result of *implicitly held beliefs*, unconscious cognitive constructs that influence motivation, behavior, and affect. Given that implicit beliefs are not dependent on someone actively endorsing them, gender-STEM stereotypes have the potential to shape choices by subtly constraining preferences, actions, and attitudes without individuals being consciously aware.

Stereotyping of women and men is a systemic problem that occurs throughout all institutional levels of STEM, beyond that of student peers and coworkers. Teachers' implicit

gender-stereotypes have also been shown to predict differential expectations depending on the gender of their students (Chalabaev, Sarrazin, Trouilloud, & Jussim, 2009). Specifically, within STEM fields, Nürnberger et al. (2016) looked at the extent to which differences in math/language gender stereotypes among teachers affected tracking recommendations for math/science in comparison to language-oriented secondary school careers. They found that boys were more likely to be recommended to math/science-oriented schools versus higher rates of language-oriented school recommendations for girls. They found that the more preservice teachers attributed behavior or personal characteristics to a biological basis of gender, the more stereotypical their tracking recommendations became (e.g., more male attributions resulting in math/science recommendations and more female attributions resulting in more language-oriented recommendations). Researchers state that even though stereotyped tracking recommendations occurred due to implicit bias, they have the potential to be seen as an example of differential treatment, with the potential to have a significant impact on subsequent career choices of women and men.

The transmission of gender stereotypes and attitudes from teachers to students (or employers to employees) is important, in that students and employees then operate, think, and behave per these stereotyped beliefs, which impact how they interact with their peers and how they themselves, transmit information/stereotypes to those they encounter. Lane (2012) suggested four behavioral mechanisms by which teachers (whether in a formal setting, parental setting, or work setting) transmit problematic stereotypes: differential treatment of people based on gender (as noted previously), direct teaching, nonverbal behavior, and modeling. Through these behavioral mechanisms, harmful stereotypes, such as math and science as “male” fields,

can be passed from those in power to peers, creating hostile and unwelcoming environments that can lead to female attrition from STEM fields.

What is Being Done to Address Individual and Institutional Forms of Sexism?

Given the wide variety of individual and institutional forms of sexism faced by women in STEM fields including lack of sense of belonging (Smith et al., 2012), gender discrimination (Greenwald & Pettigrew, 2014; Moss-Racusin et al., 2012), and gender stereotyping (Cheryan, Zieglar, Montoya, & Jiang, 2016; Kurtz-Costes, Rowley, Harris-Britt, & Woods, 2008; Nosek, Banaji & Greenwald, 2002), interventions must employ a wide variety of tactics. This section will discuss current actions being taken in STEM fields to address sexism and causes of female attrition in STEM fields and then will look at what the literature recommends for future actions in eliminating gender inequity in STEM. It is important to note that, despite the abundance of quantitative scientific literature on potential reasons for female attrition, there is significantly less research on implemented interventions, and almost none on the experiences of those who undergo those interventions. Instead, much of the literature focusses on quantitative outcomes of female retention and recruitment aspects of thereby leaving a gap in the knowledge of *how* these interventions are reducing gender oppression. Understanding the experiences of those receiving the interventions can help to identify what elements of the interventions are effective, what elements are less effective, and where areas of resistance might occur— all of which can be used to improve future interventions.

Need for relational components in interventions. In looking at how to decrease attrition of women from STEM, Dasgupta and Stout (2014) suggest that academic departments promote opportunities for peer networking, where women can learn and share peer's experiences. They state that programs such as these promote sense of belonging in women in

STEM. They go on to suggest that academic departments should periodically assess the climate within departments to better assess systemic inequalities in experiences and although they direct this at the faculty-level, it can also be applied at to student experience as well. By fostering inclusive environments, departments encourage research and teaching collaborations, increase professional and personal interactions, and reduce feelings of isolation.

Cheryan et al. (2017) emphasize the importance of peer support in the retention and persistence of women in STEM. They cite the creation of groups or clubs as an opportunity to create peer support among women in STEM, which enables individuals to meet and provide support to one another. However, they warn of the dangers of increasing opportunities and experiences for engaging in STEM experiences without properly addressing problematic masculine cultures (i.e., sexist cultures that embody negative stereotypes and exert discriminative practices, whether implicit or explicit). Experiences designed to intervene in problematic gendered experiences can actually serve to exacerbate gender inequality if they do not address masculine stereotypes, if they prevent women from feeling supported and inspired, if they cause women to feel they will not be successful, or if they experience discrimination through biased institutional practices. A key finding of Cheryan et al.'s work suggests that women's interests in STEM are fundamentally shaped by the cultures of STEM fields and without addressing problematic cultures, women's interest in those fields will continue to suffer. Ultimately, Cheryan et al. place an emphasis on experiences that provide women with learning opportunities and support, and that help to dispel current stereotypes of the field and that do not engage in discriminatory practices.

In their quantitative study, Diekman, Weisgram, and Belanger (2015) discuss a commonly held stereotype that STEM fields are not typically viewed as collaborative fields.

They state that STEM fields are considered less likely to offer communal goal pursuits, which are goals focused on benefitting others. Communal goals include collaboration (like working with others in a lab) and helping (the products of one's work helps others) (Diekman et al., 2010). Diekman et al. (2015) suggest that, because women tend to endorse communal goals, they tend to select our of STEM careers, even when having obtained a STEM degree. They suggest that by understanding and emphasizing the communal goal processes represented throughout STEM fields, it offers the opportunity to increase women's continued participation in STEM (and the continued participation of more communally people, in general). . They suggest that increasing the amount and quality of communal goal opportunities in STEM might act as a buffer for women against damage inflicted by negative gender stereotypes. As a result of this buffering effect, researchers believe that enhancing communal goals can serve to increase women's sense of belonging in STEM- particularly those who are especially communally oriented, as they are likely to place great value on connection with others. However, no studies have examined *how* he experience of creating communal goals/space in STEM might impact the reduction of gender oppression.

At a basic level, Diekman et al. (2015) propose simple steps such as STEM educators and professionals emphasizing ways in which their field and work involve working with and helping others (both within and outside of their field). By taking these actions, Diekman et al. predict that subjective task value of STEM endeavors will be enhanced for those who are communally focused. Several specific examples they give are the emphasis on teamwork and collaboration, done through a curricular emphasis on the collaborative nature of lab research, or combining shared science skills to solve applied problems within their communities or departments in which those involved can see immediate impacts. Diekman et al. pointed to curricular, co-curricular,

and extracurricular activities that incorporate communal pursuits in combination with the topic of study as being particularly effective. Researchers believe that students in both undergraduate and graduate STEM fields of study would potentially benefit from programs the encourage forming relationships with peers and mentors (Cheryan et al., 2017). These sorts of programs help to serve communal needs as well as address learning objectives in STEM. In the current study, we examined one potential intervention aimed at building relationships across groups (i.e., genders): IGD.

Robnett (2016) suggests that interventions targeting gender bias in STEM should focus on efforts to educate faculty and students about creating more inclusive environments. In their study examining girls' and women's reported experiences with gender bias in fields related to STEM, they found that male peers were the most common source of gender bias. Therefore, they highlight the importance of promoting values of gender equity to men in STEM with values that promote gender equity. Additionally, they suggest that these values may be maximally impactful if they are also endorsed by department leadership.

Rincon and George-Jackson (2009), also examined department climates for women in STEM as well as the role of gender interventions in STEM, particularly, engineering. They offer that increased social support-systems within women's developmental homes (e.g., academic department and/or lab) have a positive impact on women's perceptions of the department climate. Therefore, they recommend that departments work to create cultures that value collectivistic orientations that build community within STEM and increase the visibility of women in STEM. By doing this they argue, departments can help to reinforce STEM identities in women, and importantly, may also encourage male peers and faculty to see women as viable and valuable contributors to STEM fields. They highlight that challenging men's perceptions

and stereotypes of who can partake in science, can be a powerful strategy in improving department climates. This form of intervention shifts the burden of underrepresentation from marginalized students in STEM to the dominant group. However, their study did not consider what these changes might be like for men and women who are being challenged to think and interact in a new way—a potentially difficult process.

Need for critical consciousness-raising in interventions. Johnson (2012) discusses implications for these types of transformative practices within educational environments in her study of perceptions of campus racial climate perceptions and sense of belonging among racially diverse women in STEM majors. She states that transformative practices place the responsibility of change on institutions and their agents rather than on students who hold relatively little power in the educational environment. Essentially, changing climates and policies that enforce discriminatory and inequitable practices is not the sole responsibility of those who are being oppressed as a result, but it requires those with power to address their own role in oppression.

Interventions entail services and activities designed to address factors affecting underrepresented minority students' interest, motivation, and skills in STEM. However, there is significantly less focus on the role of systems of oppression and those who hold power, when addressing minority student attrition and experiences of inequity. Byrne (1993) pointed out that when a plant is not succeeding in a garden, a gardener asks what it is about the soil, water, sun, or fertilizer that could be causing the problem, rather than first blaming the plant. Focusing only on trying to "fix" the women to fit in STEM fields can overlook institutional and systemic issues that serve as barriers for women in STEM, for example, the various forms of sexism previously discussed. When programs do overlook institutional and systemic oppression, they fail to foster long-term and lasting equitable opportunities for traditionally underrepresented students, like

women, to be successful in STEM (Linley & George-Jackson, 2013). Linley and George-Jackson stated that to dismantle systems of oppression that are at play within STEM fields, programs need to adopt a multicultural social justice education frame, where they strive for equity by confronting the reality that equal opportunity is not enough to create equity due to institutional systems of oppression such as discrimination and bias.

Therefore, Linley and George-Jackson (2013) recommended that interdisciplinary research and scholarship be incorporated into STEM interventions so that they meet the needs of the targeted student population (in this case women) and so that these interventions are appropriate for the culture of the institution. Some of the literature they recommended looks at stereotype management literature, teaching and learning literature, and organizational change literature. They recommended that diversity initiatives be institution-wide initiatives, rather than a single department's responsibility. Programs that work only to "repair" students who they view as deficient rather than working towards systemic change will fail to contribute to the social change required for the advancement of women in STEM and fail to fully understand the experiences of those involved in this process.

Much of the literature reviewed, in some form or another calls for increased consciousness-raising about gender discrimination in STEM fields. *Consciousness-raising* is an educational process where members of oppressed groups come to understand the history and circumstances of their oppression (Zúñiga et al., 2007; Freire, 2008). However, as the literature suggests, STEM fields must work to address the awareness and knowledge of oppression experienced by women in STEM, as well as addressing the awareness and knowledge of privilege experienced by men in STEM. In order for long-standing change to occur, people must first understand their own involvement in patterns of privilege or oppression, how the social

identity-groups they belong to have historically contributed to these patterns, and what this history has meant in regards to one's self and others who occupy different identities. Specifically applied to gendered experiences in STEM fields, in order for long-term change to occur, men who benefit from privilege as a result of their gender must become more aware of this privilege, as well as take ownership of how privilege benefits them while harming women in STEM, and eventually contributing to gender inequality and female attrition

However, topics like privilege and power can be difficult to talk about, with many not knowing where to begin which results in the avoidance of these issues altogether. This avoidance further serves to propagate cycles of oppression (Freire, 2008). To avoid resistance to building critical consciousness, we must better understand what the learning process is like for individuals, not just what the outcome is. So how then can interventions focused on gender inequality in STEM create opportunities for consciousness-raising in safe and constructive ways and how can we understand what this complex process is like for those engaging in it so as to prevent future avoidance?

Intergroup Dialogue to Address Gender Inequity

The current study proposes to examine the experiences of members of STEM communities who engaged in an *intergroup dialogue (IGD),* a small group intervention designed to develop critical social consciousness and build relationships across sociocultural groups. While IGD incorporates many of the components called for in previous multicultural STEM literature (as will be discussed in further detail blow), the current study wishes to better understand the experiences of members of STEM communities as they begin to address and learn about the difficult and complex nature of systemic sexism. Rather than considering students' understandings of systemic oppression through quantitative constructs and outcome measures,

this study highlights the process of learning and meaning-making experienced by students as they engaged in multicultural, potentially transformative dialogues about oppression in STEM, specifically gender oppression.

Defining intergroup dialogue. IGD creates a semi-structured environment where individuals from social identity groups that have historically had a contentious relationship (e.g., female and male scientists) have the opportunity for sustained, face-to-face communication about social identities and social issues (including identity-based forms of privilege and oppression) in a safe, semi-structured, facilitated environment (Zúñiga et al., 2007). By creating a safe, semi-structured environment, difficult topics like experiences with gender discrimination, gender stereotyping, and feeling as though one is not accepted within the field (lacking a sense of belonging) can be explored in a direct and respectful way—sometimes for the first time ever. IGD achieves the creation of this a secure environment through its reliance on four crucial design elements that foster learning (Zúñiga et al., 2007). Those four elements are: (a) the creation of sustained, intimate engagement across groups, (b) attention to both process and content, (c) the use of structured activities and dialogic methods, and (d) purposeful sequencing that gradually increases the risk asked of participants and shifts in focus from the individual to social and institutional issues over time.

It is important to break each of these four components down to understand how IGD may address may address systemic oppression by building relaitonships across groups and developing a critical consciousness about systemic sexism in STEM. To start, sustained, intimate engagement across differences is derived from Allport's (1954) contact hypothesis, which describes five necessary conditions required for positive intergroup contact: (a) equal status in the contact situation, (b) common goals, (c) interdependence, (d) support of some authority, and

(e) friendship potential (Pettigrew, 1998). Members within the groups are able to feel comfortable sharing intimate details with each other, which can lead to intergroup collaboration (in this instance between men and women in STEM) as a result of creating equal status within the contact situation, as called for by Diekman and colleagues (2015) who stated that STEM endeavors can be enhanced through increased communal focus. Intergroup dialogue creates equal status through strategic group composition, where groups are composed of approximately equal numbers of individuals from the oppressed (in this instance women) and privileged social identity groups (in this instance men). The equal status, particularly in numerical representation is important given some of the suggested negative consequences of women's numerical underrepresentation in STEM (Dasgupta & Stout, 2014).

One key factor in creating equal status is the IGD facilitators' efforts to be *multipartial* (Wilgus & Holmes, 2009). To be multipartial requires the analysis and exploration of conflict using multiple viewpoints, regardless of the facilitators' own experiences, biases, or background. Equal status is additionally fostered by participation in structured activities that provide common goals that require interdependence on groups members, including those who are different than oneself. Lastly, one of the most integral pieces in creating equal status is that explicit attention that is directed to the development of relationships among group members, particularly in the early stages, which fosters friendship potential. Friendship potential relies on the cultivations of peer trust and support and ultimately provides the possibility of peer networking beyond the group (Dasgupta & Stout, 2014).

The second component of IGD is explicit attention to content and process. Differentiating between content (what is being talked about and process (how it is being talked about and the dynamics of the dialogue) is one of the primary responsibilities of the facilitators.

To explore the differences between process and content, facilitators must bring attention to information that is being communicated between groups members, both verbally through content and non-verbally through the process and ways in which group members interact. An example might be, if a several group members stated that they were comfortable talking about male privilege in their academic environment, but then remained silent during the dialogue, a facilitator might question the group by asking them to explore what their silence about the topic might mean about their true comfort level with male privilege, given their claims of comfort. Additionally, IGD incorporates an emotional component that is not typically present in more traditional forms of didactic multicultural education (Zúñiga et al., 2007), and which enhances group processes.

The final key component of IGD consists of the sequencing of dialogue and learning so that challenging concepts are introduced incrementally. As weeks progress and group members begin to form relationships, build trust, and feel safer with each other, participants are asked to engage in activities and dialogue that represent incrementally greater risks. By sequencing challenging content and activities, IGD facilitators pace the content and processes occurring within the group, both interpersonally and intrapersonally, so that group members feel equipped to respectfully navigate the experiences. Sequencing of IGD content is aided by the use of a four-stage, *critical-dialogic model* of IGD (e.g., Zúñiga et al., 2007). The critical-dialogic model of IGD is a specific model of multicultural pedagogy that involves both critical reflection and dialogue about differences in experiences of power and oppression (Sorensen et al., 2009; Zúñiga et al., 2007). The critical-dialogic model supports participants in addressing conflict that may occur due to differing experiences of power and oppression based on one or more sociocultural identities.

The critical-dialogic model of IGD consist of four stages: Group Beginnings, Exploring Differences and Commonalities, Exploring and Dialoguing about Hot Topics, and lastly Action Planning and Alliance Building. Each of these stages offers potential to address specific issues faced by women in STEM, and importantly, incorporates both women and men into the solutions. The first stage, *Group Beginnings* (Zúñiga, Nagda, & Sevig, 2002), is where relationships are formed between group members and trust begins to be built. Honest and meaningful conversations about differences are made possible in this stage, as facilitators work to create a safe environment where relationship-building can occur. Specific group guidelines and norms are created by the group in this phase to set the stage for expected levels of respect and communication. These guidelines include elaborating on the importance of sharing one's feelings to content and processes occurring within the group as well as talking about the groups understanding of and the meaning of dialogue (comparing it to other common forms of communication including debate and discussion). To assist with this stage, icebreaker activities and readings about what dialogue is and how to can be useful are utilized.

As trust is established, dialogue moves to the second stage, *Exploring Differences and Commonalities* (Zúñiga, Nagda, & Sevig, 2002), which explores areas of similarities and varitions in experiences of group members that result from social identity-group membership. Unlike other current interventions, this stage of IGD addresses one's relationship with power as a result of sociocultural identities directly, while in a supportive and safe environment. An important focus of this stage is consciousness-raising, where members of both privileged and oppressed groups (for example, men and women) begin to become aware of their roles in perpetuating systems of inequality, like those systems that exist in STEM fields that result in oppression based on gender. Structured activities that allow guided exploration and learning

around how one's own actions and experiences contribute, whether knowingly or not, to women feeling alienated and unwelcome in STEM communities. Activities that help with this include reflective writings where participants learn about the views and experiences that they share, as well as those that are conflicting. The use of the stage model is very important at the second stage, if a foundational base of respect and trust are not built in the first stage, then the ability to explore topics like the allocation of or access to resources and differing amounts of social power between individual members and groups cannot occur. The multipartiality of IGD facilitators is exceptionally important at this stage, as they must strive to create equality between members and facilitate communication of ideas that can, at times, be very emotion laden.

Moving into the third stage, risk continues to build as differences in experiences and power are further explored. *Exploring and Dialoguing about Hot Topics* (Zúñiga, Nagda, & Sevig, 2002), involves dialoguing about social issues that have historically caused tension between different social identity groups (e.g., gender-based discriminatory hiring practices, gender-based discriminatory publication review processes, lack of female faculty members/mentors in STEM departments). Participants are encouraged to communicate their personal experiences, emotions, and thoughts about the issue, and to relate their own experiences to those of other group members- particularly group members in differing social identity-groups. "Right or wrong" position-taking is discouraged by the facilitators, in efforts to allow for participants to engage in active listening and thoughtful questioning— behaviors that support dialogue compared to debate mentality.

Finally, the last stage, *Action Planning and Alliance Building* (Zúñiga, Nagda, & Sevig, 2002), centers around how members can bring about social change. This stage utilizes and builds on the cumulative experiences of the prior three stages including relationships,

perspective-taking, and critical social awareness and looks to direct group members toward action in combatting systems of oppression on interpersonal and systemic levels. The knowledge members gain about personal and societal costs of inequity, and of their own involvement in systems that perpetuate this inequality, helps them to move toward actions to foster equity and power balancing. Essentially, this stage helps group members synthesize how to use the knowledge and experiences they have acquired in IGD to take actions in their own thoughts, behaviors, and actions as well as how to apply them to intervening in larger systems, such as department policies. Outcomes of this stage are wide ranging and highly subjective. Examples of outcomes can include holding one's self more accountable for owning one's privilege (e.g., accepting and owning how one benefits from discriminatory gender stereotypes), building relationships with those from social identity-groups other than one's own in order to create equitable and welcoming work environments (e.g., academic departments, laboratory settings), challenging discriminatory policies on a departmental or institutional level (e.g., vocalizing desire for more female faculty to administrators).

Intergroup dialogue outcomes. Intergroup dialogue has been conducted a in variety of settings, but has largely been used in college populations as a means of developing a critical social consciousness and building relationships across groups (Gurin et al., 2013; Muller & Miles, 2017; Nagda, 2006). In their study of IGD group climate development and outcomes, Muller and Miles (2017) found that over the course of an eight-week IGD, 161 undergraduate college students in 19 parallel IGD groups demonstrated a significant decrease in "blindness," or lack of awareness, to racial and institutional discrimination, as well a significant increase in empathic perspective-taking. They also found significant reductions in "blindness" to racial

privilege (unawareness of White privilege) which indicate the development of critical awareness of systemic nature of inequity.

In their qualitative study of a multi-university IGD course research program involving 52 parallel IGDs centered on gender and race/ethnicity, Hopkins and Domingue (2015) found that participants reported learning skills including: active listening, suspending judgement, perspective taking, voicing, recognizing social identities and social oppression, and working with conflict constructively. They concluded that the IGD learning process enhanced participants learning about the social identities of themselves and their peers and how these social identities contribute to institutional and systemic oppression.

Other outcomes of IGD have included: development of friendship potential and recognition of the impact of social identity on individual identity and group interactions (Rodenborg & Huynh, 2006); gaining awareness of others' perspectives and finding common ground with those different than the oneself (Pruit & Kaufer, 2004); improved communication of information and promotion of civic engagement (Pan & Mutchler, 2000); increased knowledge of social boundaries and climate (Nagda, McCoy, & Barret, 2006); increased awareness of social inequalities, learning communication differences between dialogue versus debate, and valuing new viewpoints (Nagda et al., 1999); and students of both majority and minority groups who participated in IGD rated it higher than strictly lectures and readings in terms of learning outcomes and engaging in action (Nagda, Kim, Truelove, 2004).

The Current Study

A review of the literature surrounding attrition of women from STEM reveals a predominant focus on causes for the gender gap in STEM fields including, but not limited to, sense of belonging (Dasgupta & Strout, 2014; Good, Rattan & Dweck, 2012), gender

discrimination (Knobloch-Westerwick et al., 2013; Moss-Rascusin et al., 2012), and gender stereotyping (Cheryan et al., 2013; Kurtz-Costes et al., 2008). However, there is far less literature (and even fewer implemented interventions) focusing on how to eliminate the gender gap. Much of what literature there is about proposed interventions highlights the need for a focus on addressing systemic oppression within institutions and providing opportunities where members of STEM can come together to share openly experiences in order to form a more connected community. Of the interventions recommended, however, none explicitly use dialogue as the primary tool for addressing gendered experiences in STEM. Intergroup dialogue as an intervention is unique from current interventions in that it is specifically designed to create relationships across differences by enhancing communication, as well as provide education about systemic oppression.

Because there has been no research (to the best of our knowledge) explicitly examining IGD as an intervention to address gender inequality in STEM, there is a great deal we do not know about how engaging in the process of dialogue might serve to serve to build relationships between women and men in STEM, a critical consciousness about interpersonal and systemic sexism in STEM, and capacities to work toward gender equity. Given the complex array factors that contribute to the existence of gender inequality in STEM, and the lack of literature on dialogue as a tool to address this inequality, we believed a qualitative method of investigation was most appropriate to understand how group members construct meaning of their experiences as they relate to their understanding of interpersonal and systemic sexism in STEM (Corbin & Strauss, 2008). Specifically, we were interested in understanding the experiences of participants in an IGD on gender and sexism in STEM, and the learning that resulted from this experience.

CHAPTER III: METHODS

Philosophical Paradigm

This study utilized a constructivist paradigm (Ponterotto, 2005) with social justice lens. A constructivist paradigm assumes that there are multiple, valid realities, which individuals (in this case, dialogue participants) construct as they experience their reality (in this case, their experiences in an IGD related to gender and sexism in STEM.) applying knowledge of power, privilege, and oppression learned through IGD experiences to gendered experiences in STEM) (Ponterotto, 2005). The use of a constructivist paradigm in qualitative research provides a valuable means for understanding lived experiences of individuals, in their social context, and from their unique viewpoints (Ponterotto, 2005). A social justice lens places emphasis on equity for all individuals, including equitable access to resources regardless of sociocultural group membership (Fouad, Gerstein, & Toporek, 2006). As a researcher, my personal application of a social justice lens stems from the hope that results from this study will serve to empower women in STEM through the process of giving voice to their experiences of oppression and to enable men to learn and embody ally qualities. Ideally, enabling women to voice their experiences and needs to their male counterparts will bring about broader departmental and institutional change in the distribution of opportunity and resources. The current study sought to understand how individuals constructed meaning from their experiences as they were exposed to social justice content and values through their participation in an IGD on gender and sexism in STEM.

Given their shared constructivist understanding of reality-defining processes, we chose Corbin and Strauss's (2008) articulation of grounded theory methodology to help elucidate IGD participants' experiences in, and learning from, an IGD on gender and sexism in STEM. Corbin and Strauss (2008) highlight the complexities of reality construction, where widely-accepted

qualitative concepts and theories are constructions by researchers of the realities constructed by participants, as those participants attempt to understand their own lived realities.

Research Design

A *grounded theory* (GT) methodology, as articulated by Corbin and Strauss (2008) was utilized to collect and analyze data. Grounded theory is a methodology rooted in *symbolic interactionism,* a sociological theory that proposes that humans derive meaning through the process of social interactions, and use this meaning to guide their actions and interactions (Fassinger, 2005). Grounded theorists then use the meaning created through newly discovered processes of interpersonal and intrapersonal interactions to understand how groups of people define their own realities, based on their understandings of interpersonal interactions (Fassinger, 2005).

This method was chosen for several additional reasons, one of which being Corbin and Strauss' (2008) emphasis on developing knowledge that will guide practice, particularly through a social justice lens as influenced by feminist theory and research. Corbin and Strauss sought to use grounded theory to bring about social change and improve the lives of those whom they studied and from whom they built theory. They believed that through telling the stories of others in the most accurate and unbiased way, researchers may generate a societal response which can then better address the experiences and or needs of those being studied. This articulation of grounded theory works to uncover relevant conditions and to understand how those involved respond to changes and consequences of actions within those conditions. Included in those conditions are different and evolving contexts, concepts, categories, and processes, which researchers seek to uncover and eventually organize into rich description and ultimately to build theory (Corbin & Strauss, 2008).

Corbin and Strauss (2008) use Hage's (1972) definition of theory, where theory an interpretive process that creates a collection of well-developed categories "that are systematically interrelated through statements of relationship to form a theoretical framework that explains a phenomenon" (p.34). This process is unique to qualitative research. A theory is made cohesive through the use of one all-encompassing explanatory concept, that has explanatory power beyond all other concepts. Corbin and Strauss (2008) address the fact that theory can, at times, have a reductionist effect on the complex processes of reality construction that comprise it and in their most recent conceptualizations of grounded theory methodology, they permit the use of their methods for the exclusive purpose of creating rich description. However, their continued emphasis on theory building stems from its utility in making a professional contribution, through both inductive and deductive processes which serve to explore an idea fully and consider it from a multitude of different perspectives. This theory building process allows for the processes, context, and experiences of one setting to be extrapolated beyond the subjective details of a single event. Society is able to apply theory in social change efforts in a way the rich description of single events does not allow for.

Researcher-as-Instrument Statement (Statement of Reflexivity)

Researcher reflexivity, occurs when researchers engage in processes that allow them to understand how their own experiences, biases, and meaning making affect the research process (Morrow, 2005). As the principle investigator, I have been trained as an IGD facilitator as part of a graduate-level advanced group methods course and have co-facilitated one IGD group on sexual orientation. Additionally, I conducted my master's thesis on the experiences of IGD co-facilitators, making me well-versed in the theory, research, and practice of IGD. My knowledge

of commonly defined IGD processes experienced by participants has the potential to influence my interpretation of the data provided by current participants, resulting in an expectancy effect.

I also acknowledge that I am a woman receiving a Ph.D. in psychology, a STEM field. Within the context of an IGD on gender in STEM, my gender identity places me within the oppressed group, and I have personally experienced sexism due to my defiance of gendered stereotypes. In particular, I don't embody altruistic, self-sacrificing values with co-workers and faculty in pursuit of my professional goals. In addition to experiencing externally-derived sexism, I also embody internalized sexism in which direct enact sexist attitudes and emotions internally towards myself (Szymanski, Gupta, & Stewart, 2009). Recognition of this internalized sexism, made me give careful attention in recognizing my own potentially sexist biases. My combined previous experiences present potential bias in my collection (interviews) and analysis of the data. Beyond my personal experiences of gendered oppression within a STEM field, it is important to also acknowledge my privileged identity as a White woman, compared to women of color in STEM who experience multiple forms of oppression. In my analysis of the data and interactions with possible participants of color, it was critical to consider a multi-axis framework of oppression in order to prevent further marginalization of women of color (Crenshaw, 1989).

In order to manage these potential biases multiple steps were taken including: continued bracketing of thoughts and reactions throughout the data collection and analysis (Corbin & Strauss, 2008); continual conferencing with my research team; and regular meetings with an external expert on IGD. This reflexive process affected the analysis of data by ensuring multiple researchers' perspectives are contributing towards an understanding of how each participant was constructing meaning out of their IGD experience— this helped to ensure that no one person's biases influenced the interpretation of participant meaning-making.

Given that I identify as a woman in a STEM field and announced the study at organization gatherings (e.g., the monthly meeting for Vols Women in STEM) for the purpose of recruitment, I had prior contact with one group member at the time of interviews, who was at a recruitment meeting. However, prior contact with this participant was brief and restricted to recruitment— this additionally helped to ensure that I remained objective throughout the interview process. I have been trained in interviewing techniques as part of my doctoral training as a counseling psychologist and received additional training specifically in qualitative interview techniques as a result of a qualitative methods course.

Participants

The first 12 participants to contact the PI were selected per the first-come, first-serve basis as outlined in the dissertation proposal. At the onset of the study, 12 participants (see Table 1 in Appendices; all tables and figures contained within Appendices) consisting of upper-level undergraduates (junior and senior year) and graduate students who were currently completing a degree within a STEM field at the University of Tennessee, Knoxville were recruited. Efforts were taken to recruit non-social science STEM majors to make the groups more cohesive according to content. Participants were included in the interview process if they attended the majority of the sessions (at least three out of four sessions). After the PI consulted with the co-facilitators, one participant was asked not to attend the final session, after he did not attend the second or third session. Two participants who identify as men, and one who identifies as a woman did not attend any of the groups. Five of the participants who identify as women and two participants who identify as men attended every group, and one participant who identified as a man attended three groups, creating an unplanned gender skew.

STEM fields, for the purpose of this study, included biological sciences; computer and information science and engineering; engineering; geosciences; mathematical and physical sciences (NSF, 2017). Participants were recruited through emails (Appendix A) requesting their participation in a 4-week study designed to address experiences of gender in STEM. The email posed the study as an educational opportunity to increase multicultural awareness in STEM fields and offered a certificate of completion (Appendix B) should they chose to include the information in their curriculum vitae. The email contained the requirements (length of time required and what activities the group entailed) of the study and a brief description of the dialogue group process. The recruitment emails were sent to department chairs and faculty in the following departments: Biochemistry and Cellular and Molecular Biology; Chemistry; Ecology and Evolutionary Biology; Mathematics; Physics and Astronomy; Civil and Environmental Engineering; Electrical and Computer Science; Industrial and Systems Engineering; Materials Science and Engineering; Mechanical, Aerospace, and Biomedical Engineering; and Nuclear Engineering. The email requested that department chairs and faculty forward the study information to the graduate students and upper level undergraduates in their department. Flyers were posted on sanctioned university spaces including message boards entrances to buildings, and in individual labs. Emails and in-person announcements were provided to a variety of student-lead STEM organizations listed on *https://utk.collegiatelink.net/organizations* (e.g., Pipeline: Vols for Women in STEM, Institute for Electrical Engineers).

Participants were instructed to contact the principle investigator via email if they wanted to participate in the study. In total, 76 self-selected individuals contacted the PI about wanting to participate in the study or wanting more information about the study. Due to the unpredicted high response rate, following emails to the aforementioned departments and clubs, no further

departments were contacted due to the having met the participant maximum on a first-come first-serve basis. It is important to consider how selection bias may have been a factor in the participants electing to participate in the study (Geddes, 1990). Given that the study was advertised as a "Diversity Study," those who volunteered may already have had a favorable disposition and interest in favorable diversity outcomes and may not be representative of the attitudes of those in STEM fields as a whole.

In addition to the IGD participants, the two facilitators of the groups were also considered participants in this study, given that their weekly reflections were included as a source of data. (The principle investigator was not a facilitator to reduce bias in data collection and interpretation.) The two facilitators were recruited directly by the principle investigator to partake in the study given their training, familiarity with IGD, and genders. One facilitator was a 28-year-old White, woman and the other was a 32-year-old White, man. Both facilitators were currently obtaining their doctoral degrees in counseling psychology from the University of Tennessee, Knoxville, and had completed the same advanced group course on IGD as the principle investigator. This was the second IGD that each of the facilitators facilitated, but the first one they facilitated together. The facilitator who identifies as a woman previously facilitated an IGD on race/ethnicity and the facilitator who identifies as a man previously facilitated an IGD on religion. The facilitators were each paid $100 for their role as facilitators/participants.

Group participants were paid $15 for each session they attended and $15 for attending the post-dialogue interview. Thus, IGD participants had the potential to earn $75 total for their participation in the study, which they received upon completion of the post-dialogue interview.

Participants were compensated for each session they attended, regardless of if they attended all sessions. Facilitator participants were paid $25 for each session they facilitated, totaling $100.

Structure of Dialogues

Dialogues were conducted using a modified version of an established IGD protocol as described by Zúñiga, et al. (2007). Students participated in four, two-hour dialogue sessions over four consecutive weeks of the Fall 2017 semester (see Appendices B-E for detailed outlines of each session and corresponding session materials). The length of each session was determined by modifying the Zúñiga et al. protocol to a condensed period and including time recommendations from another dialogue protocol, the *Public Conversations Project* (Herzig & Chasten, 2006). The dialogue group had between 8-10 participants at varying times throughout the group.

Through adherence to a universal protocol, bracketing personal thoughts and reactions following each session, conferencing between co-facilitators prior to and following each session, and meeting with an external authority on IGD, the co-facilitators and researcher worked to achieve multipartiality about the dialogue topic in which they become aware and actively strive to minimize any potential biases or experiences of transference (Corbin & Strauss, 2008). The co-facilitators were clear with participants throughout the dialogues that they were concerned about addressing power and oppression as it relates to gender inequity in STEM fields, that they recognized it was potentially a difficult topic to discuss, and that their purpose was to provide a safe and supportive environment to members of all genders within STEM fields to begin to dialogue about the issue. The same information was communicated by the researcher during data collection in the form of interviews.

Participants who participated in interviews, attended three or four dialogue sessions, each with a distinct curriculum and objectives (Appendix B-E). Participants were assigned three "homework" assignments over the course of the dialogues in the form of two readings and one experiential activity, designed to foster dialogue. Facilitators emphasized that these homework assignments were required as part of the participation in the study and therefore required for payment. The last ten minutes of the second hour of each session was provided for participants to write down their thoughts, emotions, and reactions to the session. The facilitators were also required to write about their experiences, thoughts, emotions, and reactions to the group following the conclusion of the session. After the conclusion of the fourth dialogue session, participants were contacted by the principle investigator via email to schedule their individual interviews.

Post-Dialogue Interviews

Following the last session of the dialogue group, participants were individually interviewed about their experiences in the group. Interviews lasted roughly 30-60 minutes, depending on how much the participant shared about their experience. The interviews were conducted by the principle investigator. The interviews were audio recorded and transcribed verbatim. Participants were given the opportunity to create their own pseudonym, or were assigned a pseudonym if they indicated no preference.

Interviews were conducted in a grounded theory format, which entails largely unstructured interviews which have been found to produce the most "data dense" sources of information (Corbin & Strauss, 2008; Corbin & Morse, 2003). Interviews began with the following statement drawn directly from the protocol created by Corbin and Strauss (2008) for conducting grounded theory interviews: "Tell me about your experience in your intergroup

dialogue on gendered experiences in STEM fields?" Corbin and Strauss stated that conducting unstructured interviews allows researchers to gain the most densely saturated responses, hence the open-ended question. However, they suggested having a predetermined set of questions that help to guide an interview rather than dictate it. These predetermined questions were heavily used during the interview process, as many of the participants were initially very minimal in their sharing. The semi-structured questions specifically addressed how the dialogue impacted the participant's understanding of power, oppression, and advocacy skills in combatting gender discrimination (Appendix F). These questions served as prompts for discussion when participants had difficulty starting or thinking of how to share about their experience. Each interview contributed to a growing understanding of the meaning-making processes that had occurred in IGD and helped to inform potential content areas/questions the researcher for successive interviews. Interview questions evolved over the course of the interviews to better understand the meaning-making experience of the participants— one example is the addition of a question regarding participants' opinions on successes and failures of the group, as well as recommendations for future groups.

Data Analysis

Data analysis involved the coding of weekly written reflections and participants' post-dialogue interviews using Corbin and Strauss' (2008) analysis system. Interviews were transcribed using and online service, Rev. A team of two doctoral students in counseling psychology and one undergraduate research assistant composed the data-analysis team (Table 3). The two doctoral students included the principle investigator and one other student within the same counseling psychology doctoral program. The undergraduate research assistant was a

senior psychology major and had herself, previously participated in an IGD focused on gender as a part of an undergraduate multicultural psychology course at the same institution.

As the principle investigator, I was the primary analyst of the data, conducting the line by line coding, and creating the initial themes and integrating them into a conceptual framework. The research team was used to provide feedback, challenge my data analysis, add to emerging thoughts, raise insight into factors I had not considered, and to bring light my own subjectivities as a researcher. I additionally utilized the coding team for consultation and feedback on codes and emerging themes, as well as the final conceptual framework (Elder, Brooks, & Morrow, 2012). To accomplish this, the analysis team was provided with my data analysis files, including initial codes, themes, memos, diagrams, and annotations which created an audit trail which enhanced peer debriefing with the analysis team (Elder, Brooks, & Morrow, 2012; Marshall & Rossman, 2010). They reviewed this work, creating their own memos and interpretations of the data (including the creation, deletion, or editing of codes that I created). The analysis team's feedback was then incorporated into ongoing data analysis but the PI. The PI and analysis team additionally met in person to review the final conceptual framework creation and list of categories and subcategories. This process helped to ensure methodological integrity (Levitt, Motulsky, Wertz, Morrow, and Ponterotto, 2017). This method is commonly used for qualitative research, and was selected from research published by Elder, Brooks, and Morrow (2012), in which the analysis team specifically used Corbin and Strauss (2008) grounded theory.

Weekly journals of both group participants and co-facilitators were reviewed by the PI for initial themes prior to the beginning of interviews. These preliminary themes were used to inform initial interview questions, which evolved throughout the interviews according to the

semi-structured nature of grounded theory interviews (Corbin & Strauss, 2008). Raw codes from these journals were additionally incorporated into the development of the final conceptual framework, although they were not entered into Nvivo Pro 11, as were the interviews given that the journals were handwritten.

Line-by-line analysis of each interview was conducted using the qualitative analysis software Nvivo Pro 11, to identify *concepts,* words that stand for ideas in the data and range in complexity and level of abstraction. Concepts identify *processes* which are actions, interactions, and emotions that occur in response to one's experiences that are represented in the data. An initial review of the data using the line-by-line analysis identified each new concept, which was then given a label and added to a compiled list of open codes. *Open codes* are considered the basic concept of Corbin and Strauss' (2008) grounded theory, from which all description and theory are derived. Open codes were then grouped into higher-order concepts known as themes. In previous editions of their book (1990, 1994), Corbin and Strauss termed this step *axial coding,* however in their most recent book, they feel that the term suggests a sequential nature of analysis rather than simultaneous with open coding as it should be. Following open coding and initial theme creation, another round of hierarchical coding occurred in which initial themes become sub-themes and were grouped into final categories.

Throughout all levels of the data coding process constant comparison was employed. *Constant comparison*, the act of comparing data from new interviews to existing data, enables researchers to better understand processes occurring within the data and to continually reevaluate one's understanding of the phenomena being studied (Corbin & Strauss, 2008). Data were also analyzed for *context*, the conditions that include problems and circumstances which demand individuals to respond in a variety of ways. Ultimately, processes, themes, and context were

combined to create and refine a conceptual framework of the experience of participating in an IGD on gender and sexism in STEM.

Ensuring Trustworthiness

Trustworthiness, a standard of quality and credibility, was achieved through the researcher's adherence to Morrow's (2005) recommendations for conducting and writing qualitative research. Morrow notes constructivist paradigm-specific criteria for ensuring trustworthiness, which include *fairness, authenticity,* and *meaning*. *Fairness*, was achieved by seeking out others' constructions of the data beyond that of the principle investigator's construction. This was done through consultation with the research team. *Authenticity* is composed of several different elements including ontological, educative, and catalytic authenticity. *Ontological authenticity* improves and elaborates on the participant's own construction of the experience. This was achieved through interview tactics acquired as part of clinical counselor training, which elicit meaning-making through promoting participants' communication of the experience. *Educative authenticity* occurs when participants' comprehension and appreciation for others' construction of experience is furthered, like through perspective-taking gained through IGD experience and through sharing of results with participants upon completion of the study. *Catalytic authenticity,* the degree to which action is stimulated, was achieved through emphasizing social justice goals that promote opportunities for critical consciousness development. Lastly, *meaning* takes into consideration a deep understanding of context, culture, and rapport between researchers and participants as meaning making occurs. Without a rich, textured consideration of these factors, researchers run the risk of imposing their own construction of meaning to areas that are foreign to them due to inherently different experiences.

Trustworthiness of data was ensured through Morrow's constructivist paradigm-specific criteria and helped to ensure that researcher bias did not interfere with the meaning-making of participant's. One example how the utilization of this criteria was helpful was in the consideration of the PI's personal experiences with sexism and internalized sexism. These criteria described by Morrow were achieved through *praxis* (Patton, 2002), the integration of theory and practice, in which constructivist theory of meaning-making is integrated with methodological design and practice of grounded theory (Corbin & Strauss, 2008).

CHAPTER IV: RESULTS

One core category, five categories, and 12 subcategories emerged (Table 4) to create the conceptual framework of perspective-taking for participants (Figure 1). This conceptual framework serves to elucidate how participant's created meaning from their IGD experience. The core category was *Perspective-Taking*. The five categories were: *Personal Barriers, Work Inside and Outside the Group, Change in Culture, Ally Development*, and *Critical Consciousness Development*. Each is described below.

Perspective-Taking

Members were able to use the dialogue to successfully navigate and learn from the experiences of others, even when they may not have been in total agreement, and then to apply what they learned from this process. This category emerged as the core category throughout participants' meaning-making process of the IGD. It became apparent that all categories in some way either contributed to participants' ability to engage in perspective-taking or occurred because of perspective-taking. Ari, for example, described how IGD pushed participants to see the perspective in a way that felt different from their STEM training:

> We went to a lot of areas that it was gray. It was neither good or bad and we got that. Experiences that we have can be good in our point of view but very bad and destructive for another group of people. It was good to see that.

Similarly, Mahyar, a non-native English speaker, stated:

> Yeah. If I did not participate in this group, I don't [*sic*] have this knowledge of, for example, how different girls in different departments are suffering or feeling or struggling in the fields. So without having this knowledge, this perspective, if this knowledge [was] taken away from me…So I think that I did not see the other side of that

> field because I was looking at it like black and white, but it is not exactly black and white. You know what I mean?

Participants appreciated the different identities and perspectives offered by group members who embodied differing sociocultural identities including gender, race, and religion and still wanted to see more diversity of perspectives. Michelle described wanting more male voices in the group:

> I think at times it was a little unbalanced in that way, where some of the opinions of the males in the group, I felt like they were holding back because they felt a pressure of all these women were like, "Yeah, we're oppressed!" I think that could have helped, but there's no way to avoid that.

Greg described wanting more racial diversity: "I suppose I don't know for sure, but it seemed that a majority of the group was all the same ethnicity except for two members and neither of them I think spoke nearly as much as the rest of us." Mahyar described the perspective-taking experience:

> When people share different views in dialogue, and maybe some of them are in opposite with our views [*sic*], maybe some of them in the same line [*sic*]. But when you hear something opposite and when they explain and share their views with us, and we also share our views with us [*sic*], so…both sides can find something new from different perspectives. And then maybe we thought that our thinking about for [*sic*] this specific situation is 100% true. But later, we found out there are some, for example, "cavities," there are some defects in them and these are the defects and "cavities." And then they find out, "Okay, so this system is not perfect or these people are not always perfect or behaving in the same manner in different departments."

More generally, Alice described the experience of perspective-taking in IGD this way: “It was cool to be able to see different perspectives, and then be able to work through them—not necessarily trying to change anyone's mind.”

Personal Barriers

Participants described processes that posed challenges for them personally to fully contributing or learning from the IGD process. These barriers appeared to be more internally-occurring processes that impeded their abilities to fully engage or benefit from the IGD process. Two subcategories of Personal Barriers emerged: *Reliance on Objective Thinking, and Missed Opportunity.*

Reliance on objective thinking. Participants stated that it was sometimes difficult to engage with more emotional content, given the objective, analytical emphasis of their STEM training. Alice described this process:

> Everyone's in STEM, so we're all kind of objective about it. It was kind of hard to get that emotional component in there as well, unless you're really into it then you could maybe get a little more of that emotional component. Even just me, I'd try to think of it objectively and I'd be like, okay, there's really no reason to discriminate [in STEM culture]. You know, people aren't like that.

Similarly, Greg described:

> I know it [lack of emotionality] was an issue that the facilitators mentioned pretty frequently even that we as a group would often talk to each other about things in a very like logical, analytical way. And I know that I, myself, would use the phrase “professionally” or “professionalism” to sort of like distance myself emotionally from something like that. I suppose us, as a group, we kind of tried to take emotion out of it.

Despite a reliance on objective thinking, participants did express a recognition that more use of emotion in the dialogue would have helped to enhance the process. Audrey explained:

> It would be interesting to me to have people who aren't so analytical come and talk because they are probably more likely to have an emotional response. To say what they feel about something, not what the data says about something. I was going to say, I know that wasn't the point of this study. It's just something that I kind of wished there had been someone there other than the facilitators to talk about something not so cut and dried.

Jack, one of the co-facilitators described his experience with participant objectivity in his weekly journal:

> The content of today's session was analytical and discussion-oriented. Group members shared mostly empirically and intellectual driven [*sic*] content, and conversations were typically about feedback to [subject of a video used in group] from the "scientist's perspective." As a group facilitator I used more probes for emotional and experiential content."

Missed opportunity. Participants provided examples of missed opportunities where they did not express a thought or experience in the group that they felt would have deepened the group process. Michelle described the difficulty of finding a balance in how much she shared in the group, and at times refraining from providing potentially useful information and perspectives:

> I've read a lot of research, and I have a lot of anecdotal evidence that I want to share. But that's not the point. So, the listening part was the struggle, where it was just like, you have to listen and take what they're saying at face value. Even when often what they're saying is something I've read about, I know that view, I know why it's flawed, and I want

> to explain to them why it's flawed. And at times, I just had to bite my tongue and learn how to do that. But, only early on. By the third session, I think, the moderators were encouraging us to don't [*sic*] bite your tongue. If you know something, share it.

Audrey described withholding information from the group due to past negative experiences she had when she shared parts of her identity and opinions: "I wish that I could have introduced that [belief that certain group members were closed off to opinions differing from their own] as part of the conversation. I think that's something I withheld because I felt like in my previous experience talking about stuff like that, just getting attacked back, rather than listened to."

Work Inside and Outside the Group

Participants described processes related to the pedagogy and design of IGD and are documented in past IGD research as expected processes and outcomes. Four subcategories emerged: *Prior Experiences, Structural Components of IGD, Emotional Reactions,* and *Processing IGD Outside of Group.*

Prior experiences. This subcategory describes experiences, knowledge, and assumptions held by participants prior to the start of the IGD and which impacted the IGD process. Alice described being unfamiliar with dialogue: "I didn't really know what a dialogue was necessarily." A lack of familiarity with IGD resulted in some participants entering the group with no expectations, Michelle said: "It was my first experience. I had no expectations." Similarly, Mahyar spoke about his lack of previous understanding about the presence of sexism:

> At first, I thought that maybe they are just telling their story or just made [*sic*] up something. And when they're explaining in more details to give them names [*sic*], give the place, give the professors, for example, just the buildings' names and which department they are studying in. Then I later found out that it might be somehow true.

> When the girls might share the same experiences, something similar to what she said, then I found out, okay, that pretty sounds reasonable.

Other participants held prior knowledge and experiences that enhanced their abilities to contribute to the dialogue in a meaningful way prior to the start of the IGD. Alice described having conversations with her sister:

> My sister's very, I guess she's more into this kind of thing. We had talked about equality versus…I think it was equality/injustice or something like that. It was like, you know, giving everyone the same isn't always…you can give everyone the same thing, the same amount, but that doesn't make everyone equal because there's inherent differences. That kind of related back to me and I was like oh, I have something to say about this because I already knew about it.

And Michelle described direct experience she's had related to gender in STEM:

> I'm a huge advocate for diversity in STEM, so I run a couple organizations on campus that support women and minorities in science, and support scientists who are interested in going into government or policy. So, I think about these things a lot, and read about them a lot.

Structural components of IGD. Participants described structured activities and processes that are intentionally designed to facilitate dialogue and learning. Michelle shared: "The readings were really helpful to have that academic perspective of what was happening." Multiple participants noted how the ground rules helped participants feel more comfortable and established respectful boundaries, both of which created a safe environment. Leah described the importance of ground rules:

> Yeah, so we made a list of rules, but I didn't really look at them and say, "Oh, am I doing this?" But I think we all followed them pretty well. But the rules are a pretty good embodiment of what communication should be, like not arguing—having a discussion instead. Yeah, I mean, some things that go along with that as well. I mean, just like not raising your voice or calling anybody out rudely, or things like that.

Experiential activities used during the dialogue helped to enhance participants' understanding of complex topics like power and oppression. Tyson described completing a handout where group members are asked to identify their different social identities and the associated forms of privilege and/or oppression:

> It's nice to sometimes make things explicit that are only implicit in your mind. Like every time I fill out a survey I write that I'm White and male, but I've never written before explicitly that I'm non-indigenous or something…but things that are assumed in your own mind or you don't confront explicitly, writing them down pen and paper is a nice exercise, even if you don't change your opinion wholly. So that one was cool.

Greg had this to say about the "Jelly Bean Activity," a modified form of a privilege walk, where facilitators read a list of privileges and participants take a jelly bean from a bowl in the center of the group and add it to a clear plastic cup in front of them if the privilege applies to them: "I really enjoyed doing the privilege activity that we did with the jelly beans. It was interesting to see that or to have your privilege visualized for you." Leah described a way in which the Jelly Bean Activity was helpful for her:

> Because I think it kind of quantified something for me, so I could put numbers and images with it instead of saying, "Wow, they feel this way." I think it was…Yeah, it

> definitely quantified something. So, I mean, as an engineering student, I could kind of see things better and say, "Oh, well that's where everything kind of is distributed."

This sentiment was also supported by Alice in her weekly reflection where she wrote, “The jellybean activity was a great activity! It was a good visual way to see aspects of privilege and how if differs with respect to everyone in the room.” All participants reported that the facilitators enhanced the IGD experience through their knowledge and group facilitation skills to address difficult topics and further the dialogue. Greg shared:

> Listening to some of the facilitators’ personal stories and then being able to share that like something as personal as they would share makes it easier to share things from my own experience or I would imagine other people felt similarly to this on some of the things that they shared.

Mahyar shared something similar:

> Even [the] two facilitators help us to push further and talk more, and they also share [*sic*] some idea, some opinion, some experience they had. So, they somehow steered the way to how to find the correct path to continue this dialogue one step further.

Relatedly, Leah described how the facilitators’ use of emotional exploration enriched the IGD:

> It was a lot more raw, as far as what we accomplished. Yeah, I guess we saw a side of each other that we hadn't seen previous sessions in the fourth one, and it kind of, I guess gave us a chance to finish on a more genuine note, I suppose…So, I guess just because everybody was talking about…I don't know how to put this into words. I guess just because we were talking about how we felt, which led to trust and talking about other things, and such.

Participant engagement increased across sessions, described by Tyson: "So it was obvious to me at least being there that folks were a little more hesitant in the first session. I'd say that changed a lot in the third and the fourth sessions." Also contributing to comfort, participants stated that building relationships through trust was essential for the group process, as described by Michelle:

"I felt more comfortable throughout the process. Early on, it was still a bunch of strangers. I didn't know how much could be revealed. But I think that everybody did a really good job on opening up. So, we got relaxed fairly quickly."

Emotional reactions. Despite participants noting that it was difficult to engage in emotions, when they did, it was particularly powerful. Participants experienced a variety of emotions as a result of material covered in the IGD. These emotions included but were not limited to anger, nervousness, sadness, and defensiveness. Ari, a non-native English speaker, described how experiencing anger while watching a video about a controversial Google memo the group to process more deeply:

> We feel belonged [*sic*]. We are feeling that...I feel like I have achieved good things in my life but when you hear that, in a sense of, a written memo in somewhere like Google, it makes you kind of angry. And, yeah. And that was the thing that I think pushed us.

Mahyar described experiencing surprise about what he learned from diverse perspectives in the group: "It was very instructive and very surprising because actually, I expect not so much broad views from different peoples [*sic*], and I learn [*sic*] many things from them, for example, about how girls suffered from the STEM fields, for example." Audrey described discomfort as she made sense of her intersectional privilege while in the group:

> I just hated that because I was White, upper middle class, married parents…I graduated top of my class in high school, I'm on a scholarship. I feel like I was being pointed at and said, "It's because you're privileged." Which is not what the point of the activity was, but to feel that defensive part.

Tyson spoke about being nervous at the beginning of the group: "I'd say that the first day there's like a little bit of nervousness. You're around a group of people that you don't know and I spent probably a lot of my time trying to figure out people in the group."

Processing outside of the group. Participants described seeking out non-group members, like friends and family, to process their thoughts and feelings about group content, or to enrich their understanding of material covered in the group. Michelle describes: "I'd get in my car and call a friend and talk about something that was on my mind from the session, then it'd be done for the week in the anger." And Alice described talking with her roommates about IGD material:

> My roommates heard me talking about it a lot…You know, I guess I'm just more aware of it now, and I want to know if other people are. Have they had experiences, just because it's something new and I think it's you know, something that we need to be aware of if we're not.

Change in Culture

Participants described how knowledge and skills they learned in IGD (e.g., active listening, suspension of judgment, perspective-taking, communicating respectfully, recognizing social identities and social oppression, and working with conflict constructively; Hopkins & Domingue, 2015) may help to reduce cultures of privilege within their professions and

workplaces. Two subcategories emerged: *Knowledge-Attitudinal Shift* and *Application of Individual Experiences to Larger STEM Culture.*

Knowledge-attitudinal shift. Participants describe how IGD was effective in changing their attitudes, beliefs, and knowledge related to oppression and privilege, or how they see this information being applied to change cultures of male privilege. Mahyar described:

> Maybe in the department that there are [*sic*] minority girls, the male students will behave differently because they can understand, for example, how girls are suffering in STEM in some fields, somehow. This changing the beliefs of a group of, even a smaller group of people, will help the change later in the other students that are coming and joining that department or university. Later on, for example, after five years, these biased views will be changed like the superstitions [beliefs] that people have, for example, from hundred years back does [*sic*] not exist anymore. Or some of them exist but people still believe in them because of no reasons. But if somebody tell them [*sic*], "Okay, the gods, for example, the moon gods, the sun gods that you're worshipping does not [*sic*] really exist, 50%, 80% of your life is just on [*sic*] your hands, so you can do it by your own. You cannot just worship them," they are not these things. Even the understanding these beliefs, expressing them to others, share them [*sic*] with others will help the next generation to become more thoughtful and behave in a different manner. And this biased view will be [*sic*] finally disappear.

Participants also described how they better understand and more fully support organizations and institutional policies that support women's equality in STEM fields. For example, Greg describes a shift in his understanding of hiring practices in STEM as a result of his IGD experience:

> That's hard to put into words, I suppose. I think that the dialogue gave me a lot of answers to questions that maybe I had been struggling with or questions I wasn't even sure that I had but once I got the answer I knew…I would I suppose reference back to hearing the two members of the group discuss the value of intentionally hiring women over men or promoting women over men. Not to the degree where it would be like bad for the company or bad for…Like a discrimination, but if you have two equal candidates and one of them is a woman and one of them is a man, maybe intentionally choosing the woman. Or recognizing that maybe your more positive leanings towards the male or from your interactions is just from the similarity that I might share with them or the…I suppose that's what kind of what privilege would be or it's their privilege I suppose.

Application of individual experiences to larger STEM culture. Participants used their experiences in IGD to inform how cultures of privilege in STEM might be changed outside of the group. Alice described how she felt discussing the material covered in the IGD could successfully be done outside of the group, like in other academic or professional STEM settings:

> I guess that kind of makes it quote-unquote "okay" to bring it up in that environment [IGD] maybe, so it's like you know these are other people in STEM, they also know this. Maybe other people in STEM also know this. You know, everyone was understanding so I mean I guess it makes me think that other people in that realm can also be respectful and understanding. That just shows in the dialogue that we could have that respectful discussion all being people in STEM and that probably you know, in other environments we can have that as well.

Mahyar described how he believes departmental organizations can provide women in STEM opportunities to feel a sense of belonging and support, based on the knowledge and experiences he gained during IGD:

> But this [female attrition in STEM] could be changed if, for example, the male counterparts changed their viewpoints. They do not look at her, for example, as a gender level [*sic*]. For example, they look at her as his colleagues, for example, his teammate, something like that or lab mate. That makes more sense. And so maybe that's why some of the girls in some departments have the, for example, the special group for them that help them to flourish, help them to develop, for example, in their fields more. That's a good idea, I think. Maybe in some departments, they have, for example, some sisters group [*sic*] in, for example, the electrical engineering department. They make this tool [*sic*], for example, to help the other girls who are studying electrical engineering to have the access to different levels of knowledge or different levels of things that, for example, only male counterparts have the access before [*sic*]. And they are just, for example, allocated as their property [resources specifically allocated to programs dedicated to women's equity in STEM]. So that's the thing I have thought. But before coming to this dialogue, I have never thought before [*sic*].

Ally Development

Participants describe engaging in actions and processes that promote an equitable and inclusive environment for women and men in STEM. Three subcategories emerged: *Action Planning Techniques, How to Better Communicate,* and *Mentoring Influenced by IGD.*

Action planning techniques. Participants discussed different techniques and actions they could take to reduce gender oppression in STEM. Alice described feeling more comfortable saying something when she is exposed to sexist attitudes or behaviors:

> I mean I think that you know, especially having participated in the dialogue and seeing how important it is, that people know these kinds of things. It's important to say something, and to say so in a respectful manner. That's all you can really ... you can't control other people's reactions. Maybe they have a knee jerk reaction to being questioned or something, because they maybe don't have the experience that I do [IGD participation], they don't have that to kind of draw on, but I do think I would feel more comfortable saying something. In the last session I think at the end, we did…I don't remember what exactly they're called but action plan or something like that. That was one of my things you know, I couldn't really expect to do something super big, just because that's not the kind of person I am. You can call attention to things you see in your everyday life and you know, let that happen I guess.

Similarly, Leah described transferring her learning to other forms discrimination:

> Yeah, I mean if anything sexist or discriminatory came up at all, I mean, anything discriminatory, not just women in STEM or anything. I feel like I would be better equipped, say, to do that [speak out against oppression]. I'm pretty big on not saying things unless I have all the information, 'cause [*sic*] I don't want to say something and be wrong or whatnot. So, I think it kind of helped me feel confident enough to say, you know, "don't do that, that's not cool," kind of thing.

Audrey described how she could ask more questions to better understand others' experiences: "If someone says, 'I feel this way about something,' to ask them, 'What makes you feel that way?'

Or, 'Why do you feel that way? Do you have an experience that makes you feel that way?'" Tyson described how he can be an ally to his immediate peers on a daily basis:

> I think I'd be much more likely…I mean, this is probably still true, but especially previously, I'd be much more likely to talk about policy or large ... Yeah, things in the news or big news stories, whereas now maybe I'd be more likely to talk to my colleagues about their experience yesterday with some sort of casual sexism or something.

Participants shared that they had a desire for continued communication with IGD members, following the conclusion of the group. Michelle spoke about a desire for continued contact with a group member who had differing views about how to address sexism in STEM:

> Some of the way that we should be activists, we think differently about. So, I want to understand that, and I think that there's a need for both [views of change]. But how those two types of activists can work together to simultaneously in our own ways make change.

How to better communicate. Participants learned communication skills as a result of IGD that allowed them to more effectively share their thoughts and experiences, especially about oppression. Michelle described how this skill was particularly helpful when communicating with others in STEM fields who may not share the same views or experiences:

> Mainly just that listening. I feel like I improved. I still need work. Well, I know communicating when I think about something. A lot of these things I read about from other people who are more eloquent at describing it. But having to say what I thought out loud to other scientists, who maybe don't agree with me, that's helpful. I learned how better to communicate what I'm thinking and what I've learned and what I know about something that I don't study, but have a passion in.

Alice described using respectful communication skills to engage in difficult conversations about power and oppression in order to gain another's perspective:

> A lot of times when other peoples' thoughts or feelings or anything are questioned, whether it's respectful or not respectfully, they take it like as little punch like "ow, okay." You can either respond, how we did or how we were encouraged to and how we did in the dialogue as, "Okay…this is what I think. This is what you think, let's talk about it." Or, you can be like, "Oh you hit me I'm going to hit you back" kind of thing.

Mentoring influenced by IGD. Participants either applied skills and knowledge about sexism and other forms of oppression learned in the IGD to current mentoring relationships, or were inspired to engage in providing mentorship as a form of direct action in combatting gender oppression. Greg described how the IGD influenced his mentorship of his female mentee after discussing the relationship with the group:

> Just getting to hear their experiences with it and asking them the question directly and they provided several suggestions for me. All of which I, or most of which, I did take to heart and proceeded to use in our meeting that month, because we meet monthly, me and my mentee. I think it helped maybe bring a little more of a personal aspect to my relationship with my mentee and she was certainly appreciative of it.

He then provided specifics about how he implemented the skills and knowledge he learned from his IGD peers:

> The main thing they had suggested was to…Well, first to ask how she felt about it, which seems obvious. I guess I just…I don't know why I never did that before. And then the other option was just to bring in a fellow woman in engineering specifically in our major to sit in on the meeting with us if that would make her comfortable or give her the

> opportunity. And, so, it turns out that she was already pretty involved with the Society of Women Engineers.

Leah described making changes to model ally behavior for her mentees:

> Well, actually in our last session, we talked a lot about what we can do to prevent or kind of…Yeah, I guess prevent sexism. And I think…What I said was mainly I want to be a mentor or a role model to women in STEM. I'm a mentor to three young women right now, and they're all incredible, and I'd like to think they look up to me and say, "Wow, I want to be that." But that only goes so far, so I think everybody else kind of said maybe I need to call people out more, and say…Like not call them out, but very nicely say, "That was a little borderline disrespectful."

And Tyson spoke about future opportunities to apply his IGD knowledge to mentees throughout his career:

> So, I hope to be a professor some day and your role as an advisor for students or as a research mentor or whatever is partially to fix typos on manuscripts and show people how to do experiments, but it's also how to guide them through the process of science, the culture of science, the career paths. And that experience, if what it's like to be a scientist is very different for a man and a woman, then I've got to be able to know that and adjust accordingly when I'm mentoring or teaching.

Critical Consciousness Development.

Participants described an increased awareness of systemic oppression as a result of the content shared by other group members, information presented in the reading materials, and the dialogues that occurred around power, privilege, and oppression. Specifically, participants described an increased understanding of systemic sexism in ways that they had been unaware of

previously. This growing awareness involved participants recognizing the intersectional nature of power and oppression, based on their own unique identities, where they can both oppress and be oppressed depending on group membership. Greg described what this process was like for him:

> It was definitely enlightening. Getting to hear from my peers that are women in STEM, specifically engineering where my focus is. It was interesting to hear the things that crossed their minds especially in like group work, things that I would never consider. Like one point in particular, was when we were discussing privilege and there was one of the women in the group talking about how she does feel like if she makes an error in front of the class or does a problem incorrectly, it is a negative remark about her entire gender. And that's something that like I have never even come close to feeling that I thought I would represent all men in engineering. And I never even thought about people feeling that way.

Michelle described how her understanding of systemic oppression changed after participating in the IGD:

> I realized that the individual experiences of people are all valid. But oppression is talking about a systemic level. Because someone slighted you in high school and you felt bad about this, and one person happened to be a woman and one happened to be a man, and you were both scientists, doesn't mean that that was gender in STEM oppression. That was just an interaction between two people. But when it's on the larger scale, a societal scale, that's when it becomes oppression, and that's why it's a problem.

Mahyar talked about his recognition of socialized sexism that contributes to systemic oppression:

> At first, I just want [*sic*] to laugh, but since we are in a group, I don't do that [*sic*]. But later when she explained and some others [*sic*], for example, explained similar things about their past and what other generations, previous generations thought about, then I found that okay, maybe these things, at that time, exist and they just pass on without accepting that these things are supposed to be justified before you accept them. Or, there's some sort of reason behind them before we accept them [*sic*]. But they do not want to pay attention to these reasons or they do not want to listen to others' explanations or other knowledge that express the reasons behind them. They just accept them as it is, from their generation to generation.

Given the age and experience discrepancies in group members, an increasing awareness of differing levels of privilege and power throughout STEM were acquired. Leah discussed what it was like to hear an older group member discuss her experiences with sexism in STEM:

> Yeah, so there was [*sic*] some younger students, and then mostly graduate students in that, in my group. And I guess maybe because I'm younger, I still have a very optimistic view about women and stuff, and discrimination in general, but ... of the girls, she works at [scientific laboratory]. I think she was a graduate student or something, and she had a lot to say, 'cause [*sic*] she had a lot more experience than I did, which was really interesting to hear how it varies from undergrad, grad school, to industry, 'cause [*sic*] she said she had experiences of discrimination every day. And maybe I'm just not attuned to it, or maybe I'm actually just not being discriminated against, I don't know. So maybe that's my generation, or maybe I'm just not there yet [recognizing daily experiences of discrimination].

Ari described her growing understanding of oppression through the lens of intersectionality:

> I think it was a very good article, I think in the second session, how privilege can be an oppression too. That was something that I hadn't think [*sic*] about it, that how if you're ... In a society, we are all powerful in a sense. Like I'm a grad student but I'm not from US, I'm [Middle Eastern]. Someone else may be White, Christian [*sic*] so he maybe [*sic*] feels powerful in a typical community. But then, in a group of all grad, master and PhDs, he would feel powerless. It really helped me to see that. Helped me to, I think, go easier in a typical gathering of people because you would assume that ... I am powered [*sic*] in some sense and less privileged in other senses. The person next to me is sure, powered [*sic*] in some sense and less privileged in other aspects. So, it helps you see that. We are all as a single [*sic*], we are not all powerful or all privileged. And it makes it easier to see people around you as human beings, not the White, Christian, or the not educated one.

Leah described how her knowledge of power and privilege was influenced by her examination of her own intersectional identity:

> Well, it was kind of weird because this specific group, you know, it was women in STEM and everything, so really I'm both oppressed and privileged, which is kind of hard to think about. So, in a different situation I could just be privileged [racial privilege], where if I'm in engineering I'm obviously oppressed as a minority [gender], but…Yeah. It was just kind of hard to think about, 'cause [*sic*]*)* I'm not the type of person to be directly rude or discriminatory or anything, so it's just kind of hard to put that into perspective and say, well I might have unintentionally harmed somebody, which is sad, but I guess happens.

Zoey, one of the co-facilitators noted how it was challenging for her to see other's beginning stages of critical consciousness development, where participants denied oppressive experiences. In her weekly journal Zoey wrote:

I think it was also challenging sometimes to see other women who maybe aren't as critically conscious. In the past, I've expected people from the privileged group to struggle a bit [when discussing oppression] in terms of awareness and acknowledgement, but it's harder when the "oppressed" group doesn't recognize their own experiences as sexism (internalized, too).

CHAPTER V: DISCUSSION

I sought to understand how students in STEM create meaning about their experiences in an IGD on gender in STEM that focused on privilege and oppression in STEM, specifically. In efforts to reduce female attrition from STEM, the field has called for interventions that implement a variety of tactics that incorporate peer connection and support (Cheryan et al., 2017), faculty and pedagogy (Diekman et al., 2015), and institutional involvement (Linley & George-Jackson, 2013). A common theme is the need for critical consciousness-raising (Friere,1993; Zúñiga et al., 2007) about the dynamics of power and oppression that contribute to cultures of male privilege in STEM. However, despite recommendations about the need to incorporate these areas, there is a dearth of literature examining the process of critical consciousness-raising and multicultural education in STEM those receiving current interventions. There remains a need to understand what the process of critical consciousness development (or lack of) is like for participants to create more informed and effective future interventions (e.g. successful elements of interventions, or areas that may create resistance to change in participants). This study examined how those engaging in one specific gender-related interventions make sense of the experience. Through the use of a grounded theory methodology (Corbin & Strauss, 2008), this study generated a conceptual framework where the core process of Perspective-Taking was identified which describes participant's meaning-making process of IGD as they are exposed to knowledge and skills centered around privilege and oppression in STEM. In this theory, five categories were identified: *Personal Barriers, Critical Consciousness Development, Work Inside and Outside the Group, Change in Culture*, and *Ally Development*. Ultimately, a core category, *Perspective-Taking,* emerged, accounting for the relationships

between all inter-related categories that comprised the larger theoretical scheme (Corbin & Strauss, 2008). This conceptual framework of perspective-taking is illustrated in Figure 1.

Perspective-Taking

Perspective-Taking emerged as the core category in the meaning-making of IGD participants. Categories that influenced perspective taking included: *Personal Barriers,* and *Work Inside and Outside the Group* were all contributing factors that influenced the perspective-taking process. Participants described complex experiences, processes and emotions that enabled them to better understand the experiences of others with differing intersectional identities, privileges, and experiences of oppression. They then were able to apply this perspective-taking process beyond the IGD itself in ways that promote social justice and gender equality in STEM, as reflected in the categories of *Change in Culture*, *Ally Development,* and *Critical Consciousness Development*

As part of the perspective-taking process participants described learning how to understand the experiences of others and information about difficult topics like privilege and oppression in non-dichotomous terms. They reported being able to see the "gray areas" of the manifestation of power and oppression, rather than seeing others' perspectives as either right or wrong. The ability to understand complex processes without having a clear answer was a new experience for participants, particularly given their emphasis on objectivity and analytical thought. Participants described the impact of learning about and accepting the experiences and perspectives of others for the sake of understanding, rather than debating with the purpose of arriving at the "right" conclusion (Flick, 1998).

As participants began to feel more comfortable with the ability to consider complex experiences outside of black and white terms, they were able to then understand how to more

intentionally use perspective-taking in their efforts to combat gender oppression in STEM through open conversations, sharing of knowledge, and valuing the perspectives of their colleagues in STEM. These processes ultimately can help to address documented reasons for women's attrition from STEM including a lack of sense of belonging (Smith et al., 2012), lack of peer/institutional support (Cheryan et al., 2017; Diekman et al.,2015), critical gender stereotypes, and gender discrimination (Cheryan et al., 2017; Kurtz-Costes et al., 2008; Nosek et al., 2002). This intentional use of knowledge and skills to combat oppression and increase equality is also an essential component of allyship. Hence, the three processes, *Change in Culture, Ally Development,* and *Critical Consciousness Development* are co-occurring. Ultimately, participants experienced a complex relationship with perspective taking, where processes occurring within IGD influenced perspective taking or were influenced by perspective taking. Each of these processes will be discussed.

Processes Influencing Participants' Abilities to Engage in Perspective-Taking

Processes that influenced perspective-taking had contradicting impacts. Some of these processes and experiences impeded participants' ability to engage in perspective taking, while others served to enhance the ability to value the perspectives of others. Though conflicting in nature, both processes that impeded and enhanced perspective-taking were essential in helping to understand this central experience. Identifying processes that were potential barriers to perspective-taking is a crucial component in creating more effective interventions designed to eliminate sexism in STEM. Researchers can incorporate and properly plan for processes that might lead to ineffective interventions or resistance to interventions designed to eliminate gender oppression. Therefore, barriers to perspective-taking are just as important to include in the development of a conceptual framework as those processes that enhanced perspective taking.

Several of these barriers seemed to be related to the unique identities of STEM communities. Participants noted that their identification with STEM fields lead them to approach the IGD with a high degree of objectivity and an analytical mindset. This process differed from commonly held gender stereotypes which associate emotions with femininity and irrationality which are less likely to be seen as aligning with STEM goals (Cheryan, 2012; Nosek, Banajo, & Greenwald, 2002). These gender stereotypes have been attributed to female attrition, however it was apparent that both participants that identified as women and men approached challenging content with objectivity, even when the use of emotions may have had a positive impact on their understanding of the material. Future interventions would benefit from exploring if this is a unique aspect of the scientist sociocultural identity and how this might lead to missed opportunities to explore their thoughts and emotions as they relate to content that is subjective in nature and interpretation.

Relatedly, participants described aspects of their experience where they felt that there had been a missed opportunity to share or process something deeper with the group. Several reasons offered for this included having had negative experiences sharing about similar topics in the past and not wanting to offend others. However, these reasons ultimately contribute to cycles of oppression where oppression is not recognized or addressed by both those experiencing oppression and those who are being oppressive. When thoughts and emotions are not shared, opportunities to make connections and receive support from peers, both male and female, is not achievable (Cheryan et al., 2017; Dasgupta & Stout, 2014). This leads to increased feelings of isolation and lack of sense of belonging (Dasgupta & Stout, 2014). The IGD group in this sense, represents a microcosm of the real world where problematic behaviors the perpetuate gender oppression are recapitulated within the group (Bohm, 1996). Additionally, when individuals do

not share their experiences and emotions, it is also difficult for faculty and departments understand their perspectives and take appropriate steps offered by the literature (Cheryan et al., 2017; Dasgupta & Stout, 2014; Diekman et al., 2010) to change cultures of male privilege in STEM. However, for individuals to feel safe enough to share these experiences, there first needs to be an increase in the individual's general awareness and knowledge of power and oppression.

As obstacles to perspective-taking emerged in the participants' experiences, so too did processes that they identified as having helped them to overcome those same obstacles and ultimately lead to the enhanced ability to engage in perspective-taking. By examining the connectedness of these processes, we gained a better understanding of where interventions may be less successful in creating change as well as processes that may counteract potential barriers in to change. For example, participants described processes involving the development of critical consciousness that occurred as they progressed through the IGD. They described how different activities, education, and experiences, helped grow their understanding of power, privilege, oppression, and the experience of themselves and others in that process- regardless of their previous knowledge. This process began with participants' increased awareness of systemic oppression, in STEM and in society at large. This awareness was impacted by differing levels of critical consciousness of group members, depending on what their previous experiences had been (e.g., courses, personal experiences). For members with minimal previous exposure to systemic power analysis and education about sexism, their level of awareness was most impacted by material covered in IGD (Kumagai & Lypson, 2009).

Older students in the group were able to vocalize and express their personal experiences of sexism in STEM, and how they have dealt with these experiences. This level of sharing allowed for perspective-taking that helped to increase younger students' awareness of gender

oppression, even if the younger students had not felt that they experienced the same things. By modeling what it is like to label oppression and speak to strategies in how to combat it, older students also grew in their ally identities. They learned that they could use their experiences to help inform and support younger women in STEM whose critical consciousness may be at a more nascent stage due to differing life experiences. Additionally, as participants learned more about systemic oppression and specific examples in STEM (through activities and their peers), they began to have a better understanding of how different elements of sexism (e.g., harmful stereotypes, gender discrimination, unfair and differing expectations, being numerical minorities, lack of sense of belonging) may lead women to leave STEM including harmful stereotypes (Dasgupta & Stout, 2014; Good et al., 2012; Greenwald & Pettigrew, 2014; Kurtz et al., 2008; Smith et al., 2012).

An integral component of participants' increased awareness of systemic oppression resulted from their recognition of intersectional privilege. Through the use of multiple forms of teaching, communication, sharing, and perspective-taking, participants across disciplines were able to engage in a critical examination of their own intersecting identities and associated privileges and or oppression. The process experienced in IGD provided participants a critical examination of intersectionality and allowed for a greater degree of consciousness (Moradi & Grzanka, 2017). Despite an emphasis on female recruitment into STEM fields, numerical representation becomes less effective when considering the lack of appreciation for the intersectional identities of women who are already in STEM. When women are the sole representatives of their gender in certain classes (Dasgupta & Stout, 2014), their other social identities become less valued and are not as highly attended to which can also lead to a lack of belonging in STEM (Murphy et al., 2007).

Many participants were unfamiliar with the concept of intersectionality (Moradi & Grzanka, 2017) and had no understanding of how IGD functioned to help them explore the intersectionality in themselves and others. Because of this, participants had no expectations for what the group would be like. Given participants' lack of expectations and knowledge, they sought out opportunities to process the group with individuals outside of the IGD group, in their personal life. This allowed participants to make meaning of content and perspectives they heard, which became increasingly more challenging as the group progressed (Zúñiga et al., 2007). Some participants had exposure to relevant information prior to the start of the group that was useful to the group process and allowed them to more actively engage with the content and process of the group. These prior experiences enhanced the complexity and willingness of participants to engage sharing their experiences and valuing the diverse experiences of others.

Another category of experience that had a strong influence on the development of perspective-taking and valuing of diverse experiences, were structural components of the IGD process that impacted participants' ability to make meaning out of their IGD experience. Several of the structured activities are specifically designed to create intimate engagement across individual differences through the use of Allport's (1954) contact hypothesis, which describes necessary conditions required for positive intergroup contact. Equal status was established for participants through the use of assigning all members the same material, which helps to reduce the barriers caused by lack of knowledge and gives all participants a common language to work from. The usefulness of the readings is also related to the four-stage, critical-dialogic model of intergroup dialogue, where the readings helped to facilitate increased complexity in content and risk level as the groups progressed (Zúñiga et al., 2002). The creation of ground rules as part of the critical dialogic model (Zúñiga et al. 2002) enhanced positive intergroup contact for

participants through the creations of common goals, particularly in how to communicate with each other. Participants found the activities allowed them to consider power and oppression in novel ways and to apply newly acquired information. For example, one of the participants appreciated the "Jelly Bean Activity" because it provided her a way measure and visibly represent privilege, which she felt appealed to her objective, scientific natural style of thinking given her STEM identity. Experiential activities help to foster interdependence (Allport, 1954) given that participants must rely on each other and work together to create meaning and apply their developing critical consciousness. Facilitators enhanced the experiences of participants and encouraged them to consider concepts and ways of thinking that, while foreign to some participants, enabled them to construct deeper meaning from the process—this included the use of emotional exploration (Khuri, 2004). The role of facilitators is a crucial component of the critical dialogic model (Zúñiga et al., 2002), and their equal representation and intentionality of sharing power helps to establish equal status among group members.

Additional structural elements of the four-stage, critical dialogic model (Zúñiga et al., 2002) of IGD mentioned by participants were the use of emotion to deepen the process, increased engagement as the group progressed, and the importance of friendship in the IGD process. Participants noted the importance of the use of emotions in furthering their understanding the how they and their peers experienced meaning making related to sexism in STEM. Participants described the use of emotion, particularly negative emotions like discomfort and anxiety. These emotions were intentionally incorporated into IGD in order to foster overall positive group contact and is used to address ambivalence in that arises in IGD (Khuri, 2004). Although participants relied more heavily on objective thinking, they did experience emotions throughout the IGD process that contributed to how they interacted and interpreted group

processes. Though participants used emotions more rarely, communication and perspective-taking were enhanced when they did engage in emotional content. Through activities and efforts by the facilitators, participants were able to access and communicate their feelings, even if this was not their natural tendency. These emotions added to the complexity of their experiences in IGD and encouraged them to consider both the content of the group as well as how their own emotionality contributed to the group process. This experience is supported by Khuri (2004), who posed that IGD is enhanced when it attends to the affective layer of group process, particularly when negative affect and resistance are effectively integrated into group processes. Khuri stated that through the experiencing and sharing of emotions, participants are able to balance the urge to want to authentically connect with others while simultaneously wanting to feel secure in what they know and feel is "true," even if this place of security is limiting. For participants in the current study, this was seen in their reliance on objectivity. By limiting engagement with emotional content, it might also be difficult for participants to engage in the effective creation of peer connections and support (Cheryan et al., 2017) which can lead to inclusive community building in STEM (Diekman et al., 2015) and, ultimately, the missed opportunity to engage in further perspective-taking.

Participants appreciated the increased engagement in the dialogue process as time progressed, as they felt that they were better able to connect with others, share their experiences more fully, and express more vulnerability. These patterns are consistent with the four-stage model of IGD (Zúñiga et al., 2007), as well as findings by Miles et al. (2015) who found that IGD session depth increased as sessions progressed and groups begin to focus on more difficult topics about privilege and oppression. Participants cited an increase in session depth and engagement as being strongly impacted by feeling comfortable and trusting of the other group

members, which was achieved through the four-stage model of IGD (Zúñiga et al., 2007). This process is consistent with the concept of friendship potential, which is a condition for intergroup contact that Perritgrew (1998) added to Allport's (1954) initial facilitative conditions for positive intergroup contact.

Processes Influenced by Perspective-Taking

Critical consciousness had a significant influence on participant's experience of perspective-taking. It impacted categories that influenced perspective-taking, as well as categories that were influenced by perspective-taking. Mezirow (1978) describes critical consciousness development as a prerequisite for the process of perspective transformation in how we view ourselves and others. Therefore, critical consciousness development influences one's ability to engage in perspective-taking. Critical consciousness is also necessary for individuals as they engage in actions and shifts in attitudes/beliefs that serve to combat oppression (Freire, 2008; Robnett, 2016).

Participants' lack of previous knowledge about issues related to power and oppression made their understanding and acceptance of the material more difficult at first due to having to learn about basic concepts of privilege and oppression. An example of participants' lack of previous knowledge about oppression can be seen in the internalized sexism demonstrated by some of the women in the study. Internalized sexism has been shown to result in psychological distress in women, including depression, when they are unaware of its existence and/or when they engage in internalized sexism (Szymanski, Gupta, Carr, & Stewart, 2009). This lack of this basic knowledge about power and oppression is further argument for the need to develop critical consciousness (Freire, 2008). In order for perspective-taking to occur through open discourse and sharing about harmful experiences of oppression, it is critical for members of privileged

groups to understand how they and others have been affected by privilege, as well as for members of less-advantaged groups to understand how they have been impacted by subordination (Zúñiga et al., 2007) through processes like perspective-taking. Gay and Kirkland (2003) discuss how the beginning stages of critical consciousness focus more on foundational knowledge of self-reflection, including knowledge of one's own culture and associated forms of privilege and/or oppression, as well as knowledge of cultures of different sociocultural groups. They suggest that a natural starting place to begin the process of consciousness-raising is examining obstacles that may interfere with the process, rather than delving immediately into the emotional complexity of critical consciousness development. Based on what participants shared, one way this consciousness-raising might be done in STEM is to educate STEM communities on potential reasons for female attrition through perspective taking and open communication with peers about personal experiences of discrimination (Greenwald & Pettigrew, 2014), oppression (Zúñiga et al., 2007), lack of belonging (Good et al., 2012), and beyond.

The development of critical consciousness enabled participants to engage in increasingly complex degrees of perspective taking. As this process occurred, participants described how they then began to apply what they learned in IGD to challenging gender oppression in STEM. To do this, a crucial shift in knowledge and attitudes about gender-related power, privilege, and oppression occurred in participants. As their critical consciousness grew, participants became more aware of the pervasive nature of systemic oppression and were able to label specific experiences (either their own or their peers') as being rooted in institutionalized sexism. Following participation in IGD, participants' attitudes towards institutionalized actions to reduce sexism were largely positive and in support of such measures, whereas, prior to the IGD, participants may have disagreed with the reasons behind such actions and may have even

actively opposed them. For example, participants supported hiring practices designed to increase women's representation in STEM profession, even if it meant they were personally passed over for jobs.

Participants elaborated on how they believe the application of their individual IGD experiences might potentially contribute to changes in STEM culture. They described a variety of ways in which they feel this might occur. One example is through the increased use of dialogue and communication skills between colleagues to explore difficult topics like gender oppression. Other participants felt that the application of IGD skills and knowledge might increase women's sense of belonging in the STEM communities (Dasgupta & Strout, 2014; Good et al., 2012). Participants felt that engaging in IGD provided a more complex and engaging form of multicultural education than traditional didactic approaches that involve lectures or presentations that rely more on a "banking concept of education" (Freire, 2008, p. 72). In the banking concept, information is held solely by the teacher who exclusively possesses the said information until which time that they "deposit" the information into the students who have a passive role in education. Comparatively, IGD allows for communication, interaction, and perspective taking from all involved, thereby increasing engagement and ownership of the learned material. Ultimately, participants described using their critical consciousness to raise the consciousness levels of those around them in efforts to sustain a more system-wide change in gendered oppression.

Closely related and co-occurring with *Critical Consciousness Development* and *Change in Culture* is *Ally Development,* where participants described how they feel empowered to take direct actions against systemic gender oppression in STEM. Due to the co-occurring nature of these three categories, arrows were added to the conceptual framework indicating their highly

related and co-occurring nature. Allies seek justice for sociocultural groups experiencing oppression as a result of privileges experienced by the ally themselves (Munin & Speight, 2010). Allies must develop an understanding of critical consciousness that allows them to examine different levels of power afforded by their own intersectional identity and to reconcile how this power may function in the oppression of others. Allies must then work to discover what actions they can engage in that contribute to liberation of oppressed groups (Munin & Speight, 2010). Through the process of IGD, participants took an active role in the development of the critical consciousness and ultimately provided ways in which they feel they can actively serve as allies to those experiencing gender oppression in STEM. Both men and women in the group described ally behaviors, labeling identities where they had more and less power than others experiencing gender oppression based on the examination of their intersectional identities.

Following their participation in IGD, participants described feeling increased comfort implementing IGD skills including labeling oppression when they see it occurring as a result of their developing critical consciousness. Participants reported that this increased comfort will enable them to take action in challenging oppressive behaviors and policies. Participants proposed implementing dialogue skills like prospective taking, active listening, and respectful engagement in conflict (Hopkins & Domingue, 2015; Zúñiga et al., 2007).

Participants described the intentional use of communication skills learned in IGD to label oppression and to allow them to successfully share their experiences and knowledge of gender oppression with others, even when others may not have the same level of knowledge and awareness of power dynamics. This communication about sexism in STEM utilized active listening, the suspension of judgement, recognizing intersectional identities and oppression, and constructively addressing conflicting views, all of which have been found to be outcomes of IGD

(Hopkins & Domingue, 2015). Participants described being able to implement these skills to initiate dialogues with their colleagues, particularly those with differing intersectional identities and experiences. Initiating such conversations acknowledges differing experiences and demonstrates interest in providing more welcoming environments for women in STEM through establishment of peer connection (Diekman et al., 2015). This also provides the opportunity for exchanges that provide women and men with learning opportunities and support which can help to diversify gender stereotypes in STEM (Cheryan et al., 2017). The current study posits that men, as well as women, are responsible for creating such environments and therefore must be equally engaged in the process of addressing problematic masculine environments.

Unique to the meaning-making process of participants in this IGD was the impact that the IGD experience had on the conceptualization of mentorship in STEM. Participants described how they already have and/or plan to incorporate IGD skills and knowledge into their mentorship of those in STEM who may be experiencing gender oppression. Both men and women described how their increased critical consciousness and skills gained in IGD enabled them to initiate conversations about power and oppression with their mentees in ways they had not considered or felt competent to do. Participants who had already started implementing these changes to reported positive outcomes and feedback from their mentees. Importantly, men in the group discussed how the intentional incorporation of knowledge of systemic gender oppression and IGD skills when used with mentees who identify as women improved the mentor-mentee relationship and added closeness that they believe would not otherwise exist. Participants who identified as women, also noted how the implementation of IGD knowledge allowed them to better translate their own experiences of oppression into supportive learning opportunities for mentees who identify as women. As participants engaged in perspective-taking as to how

sexism may be impacting their mentees, they were able to offer more insightful peer support and create deeper peer connection (Diekman et al., 2015), both factors that positively impact women's sense of belonging in STEM (Good et al., 2012)

This shift in mentorship identity conceptualization in both men and woman may serve to decrease issues of attrition caused by lack of mentors who identify as women (Blickenstaff, 2005). If mentors who identify as men are actively aware of systemic gender oppression and take action to address how this is being experienced by mentees who identify as women (through the use of IGD skills and knowledge) then they may be able to fill the void of mentorship by mentors who identify as women to some degree. Collectively, if more mentors (of all genders) prioritize actively identifying and exploring experiences of privilege and oppression with mentees who identify as women, this will directly contribute to an eventual change in STEM culture. When mentors address and validate mentees' experiences of gender oppression, as well as are their unique intersectional contributions to STEM, this has the potential to further reduce cultures of male privilege in STEM (Blickenstaff, 2005; Good, Rattan, & Dweck, 2012).

CHAPTER VI: IMPLICATIONS

In regard to practice implications for counseling psychology, co-facilitators can utilize the group facilitation skills developed during this group in future IGDs, regardless of IGD subject. Also, though this group specifically focused on gender in STEM, facilitators gained a unique perspective and knowledge of STEM communities that can then be applied to future IGDs in STEM. For example, given participants' desire for a more diverse racial group composition, co-facilitators would be able to lead groups on racial diversity in STEM or the intersectional experiences of race and gender in STEM, with special attention to processes unique to the STEM community like reliance on objectivity.

Results from this study also have social justice training implications in both educational and industry settings. Participants indicate that the delivery of information about power, privilege, and sexism was more impactful when delivered through IGD than it would have been through more traditional, didactic forms of multicultural education. Therefore, academic departments and professional STEM work environments would benefit from implementing IGD dialogues on gender (or any social justice topic) for a more long-lasting and deeper impact on those involved. If IGD as an intervention allows for more meaningful retention of social justice knowledge, both in academia and industry, then ideally negative consequences of gender oppression such as attrition, loss of diverse ideas, and loss of capital could be reduced.
While all participants regarded their overall IGD experience as positive, many of them also indicated that they would have liked more time in the group to further explore topics.
Additionally, all participants described elements of IGD that helped to facilitate their ability to engage in perspective-taking (as demonstrated in *Work Inside and Outside the Group)* and some went further to indicate that they would like to see even more of these activities. Both longer

group time and increased activities are present in a traditional IGD (Zúñiga et al., 2002), which typically last eight or more weeks. Whereas the current study modified the protocol to include each of the four stages in one-week, future IGD work in STEM might benefit from implementation of the traditional IGD structure to allow for more exposure and processing time to the material, as well as more time for increased activities and readings. One specific experiential activity that might prove beneficial if allowed more time in a longer dialogue might be an activity similar to the *Social Identity Profile* utilized in the first group (Appendix C), or perhaps including "Scientist" as an identity within the identity profile along with other sociocultural identities. This could allow for more exploration of the specific intersectional identities of scientists as they are exposed to IGD content (Moradi & Grzanka, 2017).

The qualitative nature of this study provides insight into processes occurring during an intervention designed to foster long-term, systemic change in a culture of male privilege in STEM. Current research on related interventions is predominantly quantitative in nature and could potentially benefit from the inclusion of some form of qualitative inquiry to better understand how participants make meaning out of interventions that examine specific constructs as measures of change. Research that is able to build on the processes established in this study can lead to more informed interventions that incorporate difficult aspects of critical consciousness development including negative emotions, lack of previous knowledge, and resistance.

Conversely, future research on the use of IGD on gender in STEM may benefit from the inclusion of quantitative measures examining processes shared by participants involved in their meaning making of the intervention. Some potential constructs for future quantitative analysis include: critical consciousness development (Diemer & Blustein, 2006); communication styles

patterns, and frequency; group climate in STEM dialogues (Muller & Miles, 2017); session depth and smoothness (Miles et al., 2015); ally development (Munin & Speight, 2010); sense of belonging (Blickenstaff, 2005; Good, Rattan, & Dweck, 2012); and attitudinal measures examining implicit and explicit gender bias in STEM (Rudman, Greenwald, & McGhee, 2001). Through the use of more quantitative measures, IGD's effectiveness as an intervention can be more rigorously and experimentally tested. The current study provided insight into potential constructs to be measured in the future as a result of participant's accounts, however they should be empirically proven in order to say for sure that the IGD effects change in constructs related to gender oppression and cultures of male privilege in STEM.

CHAPTER VII: STRENGTHS AND LIMITATIONS

This study provides a unique understanding of the processes involved in critical consciousness development required to create long-lasting change in cultures of male-privilege in STEM. It examines *how* participants learn and make sense of difficult topics like power and privilege in STEM cultures, rather than focusing solely on the outcome of interventions. Specifically, the study describes processes that had positive impacts on participants ability to learn and apply social justice knowledge and skills to the STEM communities with which they are affiliated. However, the study also provided valuable information on processes that were challenging for participants as they learned about gendered power and oppression. Ultimately, the study demonstrated that through the hierarchical process of perspective taking, interventions designed to eliminate sexism in STEM can may reduce resistance and potential barriers to critical consciousness development. This study provides valuable knowledge of process that can be applied in the creation of more effective future interventions designed to combat sexism in STEM.

Future IGDs on gender in STEM should work to maintain a balanced representation of gender, given that imbalance of gender representation is a limitation in the current study. Specific attention was paid to creating equal status (Allport, 1954) through IGD design (Zúñiga et al., 2002), however participant attendance disrupted this intentional gender balance. Possible reasons for the initial lack of male participant attendance may be coincidence, or may be indicative of the previously discussed difficulty engaging men in the process of changing cultures of male privilege in STEM (Robnett, 2016). The lack of equal gender representation may also be impacted by selection bias, where those who initially volunteered may not have had as high of an interest or commitment to gender equality in STEM.

Additional considerations of selection bias should be considered as a limitation as well, given that often times diversity trainings such as this intervention are provided to individuals who do not wish to engage in a change of attitudes/knowledge/behavior within the STEM community. Therefore, the conclusions of this study may possess bias that overly indicate a desire and change in attitudes/knowledge/behavior towards gender equality (Gedes, 1990). Future IGD interventions should consider how to incorporate a more diverse and representative participant population, where individuals who may not self-select to engage in the intervention are still included. This might entail a departmental mandate or some form of institutional support/requirement. It is important to gain understanding into the processes of meaning-making for those who avoid interventions directed at achieving social justice goals.

Participants noted that they would have liked more racial diversity in the dialogue, as they feel this would have more provided a more accurate representation of perspectives in STEM cultures at large. Additionally, group membership was based on self-identifying gender and to the knowledge of the researchers, no transgendered individuals participated in the study and therefore also contributed to a lack of unique perspective taking opportunity.

Although the current study did not seek to provide experimental evidence for the effectiveness of IGD as an intervention in STEM, the lack of numerical data is still considered a limitation and should be addressed in the implementation of IGD as a specific intervention. Rather, by examining the processes of those in the group, the study was able to understand how the participants found the experience to be helpful in how they personally effect systemic change. However, a more rigorous experimental design is necessary to demonstrate the efficacy of IGD as an intervention for changing gender oppression in STEM.

Several limitations in the data analysis should be considered. Specifically, the primary analysis team was exclusively white women obtaining degrees in the field of psychology. This lack of diverse perspectives may have served to bias findings, despite following best practices of qualitative data analysis (Morrow, 2005). Considerations of limitations in the data analysis are described in more detail in the statement of reflexivity in methods.

CHAPTER VIII: CONCLUSION

This study examined how participants constructed meaning of their experience as they engaged in an IGD on gender in STEM. Specifically, I wanted to understand what the experience of learning about systemic oppression was like for individuals within the STEM community, as there is little research examining the process of diversity interventions in STEM. This is problematic given that researchers do not know what may be happening in participants' meaning-making that may ultimately lead them to rebuke diversity interventions. Additionally, much of the research on interventions aimed at decreasing gender oppression in STEM are focused on quantitative outcomes and lack understanding of the experience of those participating in the interventions. This study sought to fill that gap by conducting an IGD on STEM as a possible intervention to address gender oppression and inequality in STEM and to understand how participants experienced this process, rather than focusing exclusively on numeric outcomes of the experience. The structure and content of IGD is built to address recommendations for interventions addressing the gender gap and so provides a unique look into the processes of meaning-making in these interventions.

In sharing about their experience of meaning making, the core category *Perspective Taking* emerged. Throughout the entire IGD process, participants were engaging in processes that involved facilitating perspective taking, the act of perspective taking itself, and/or engaging in thoughts and actions that occurred due to perspective taking. This central idea informs the conceptual framework that emerged from participants meaning-making of their IGD experience. Although IGD is a specific intervention that can be used to address gender oppression in STEM, how participants experienced the process and made meaning of the challenging content can be applied to gender interventions outside of IGD. This conceptual framework highlights processes

that participants found useful as they learned about systemic oppression, their role in systemic oppression, and actions and skills that they can implement when seeking to combat cultures of male privilege in STEM.

The different components of *Perspective-Taking* are represented in the five categories that emerged. Processes that influenced participant's ability to engage in perspective taking included *Personal Barriers* and *Work Inside and Outside the Group*. *Personal Barriers* described internally driven challenges faced by participants that impacted their ability to engage in IGD process that contributed to perspective taking. And the *Work Inside and Outside the Group* described contextual and structural design elements of IGD that intentionally engage participants in critical reflection and perspective taking. These three categories influenced the process of *Perspective Taking* for participants, where they learned to value and seek out the perspectives of those different than their own based on differing intersectional sociocultural identities. Participants then applied the principle of perspective-taking to their own actions, thoughts, and emotions, as well as to STEM culture at large. This process of application occurred through three symbiotic processes *Critical Consciousness Development, Change in Culture* and *Ally Development*. *Critical Consciousness Development* described the process by which participants became aware of systemic oppression and their own intersectional roles in oppression which are different than those with differing identities. Participants described Change in Culture as processes that utilized knowledge and skills learned in IGD to help reduce cultures of male privilege in STEM through shifts in knowledge and attitudes. *Changes in Culture* occurred simultaneously as processes composing *Ally Development* participants described engaging in actions and processes that combat gender oppression and promote gender equity.

Ultimately, this study better elucidates the process of learning about challenging topics like gender privilege and oppression. It utilizes IGD as one possible intervention to teach about the causes, impacts, and solutions to gender oppression, while simultaneously examining the experience of the group members as they make meaning of this difficult material. Processes identified in the meaning-making of IGD participants may serve to better inform future interventions aimed at creating and maintaining change in gender oppression in STEM.

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APPENDICES

Table 1. Sociocultural Identities of IGD Group Members

Name	Age	Gender	Race	Ethnicity	Sexual Orientation	SES	Religion	Program of Study	Year of Study
Alice	21	Woman	White	Caucasian	Heterosexual	Middle	Christian	Ecology and Evolutionary Biology	B.S., 4th Year
Audrey	22	Woman	White	English, French, Cherokee	Heterosexual	Upper-Middle	Christian	Mathematics	Ph.D., 2nd Year
Michelle	30	Woman	White	--	Heterosexual	Middle	Agnostic	Energy Science and Engineering	Ph.D., 5th Year
Ari	28	Woman	White	Middle Eastern	Straight	Middle	Agnostic	Electrical Engineering	Ph.D, 2nd Year
Leah	20	Woman	White	American	Heterosexual	Middle	None	Biomedical Engineering	B.S, 3rd Year
Tyson	27	Man	White	Non-Hispanic or Latino	Heterosexual	Middle Class	Atheist	Ecology and Evolutionary Biology	Ph.D, 4th Year
Greg	23	Man	White	Central/ Northern European	Heterosexual	Lower Middle	Agnostic	Chemical Engineering	B.S., 4th Year
Mahyar	33	Man	White	Middle Eastern-American	Straight	Middle	Zoroastrian	Electrical Engineering	Ph.D, 2nd Year

Table 2. Sociocultural Identities of Co-facilitators

Facilitator	Age	Gender	Race	Ethnicity	Sexual Orientation	SES	Program of Study	Year of Study
Zoey	28	Woman	White	European	Heterosexual	Middle	Counseling Psychology	Ph.D, 5th Year
James	32	Man	White	European	Heterosexual	Middle	Counseling Psychology	Ph.D, 4th Year

Table 3. Sociocultural Identities of Analysis Team

Researcher	Age	Gender	Race	Ethnicity	Sexual Orientation	SES	Program of Study	Year of Study
Principle Investigator	28	Woman	White	Welsh/Irish	Heterosexual	Middle	Counseling Psychology	Ph.D, 5th Year
Researcher 1	30	Woman	White	European	Heterosexual	Lower-Middle	Counseling Psychology	Ph.D, 4th Year
Researcher 2	22	Woman	White	German/Irish	Heterosexual	Middle	Psychology	B.A., 4th Year

Table 4. Subcategories, Categories, Central Category

Subcategory	Category	Core Category
Lack of Previous Knowledge Missed Opportunity Reliance on Objectivity	Personal Barriers	
Prior Experiences Structural Components Emotional Reactions Processing IGD Outside of Group	Work Inside and Outside the Group	Perspective Taking
Knowledge-Attitudinal Shift Application of Individual Experiences to Larger STEM Culture	Change in Culture	
Action Planning Techniques How to Better Communicate Mentoring Influenced by IGD	Ally Development	
	Critical Consciousness Development	



Figure 1. Conceptual Framework of Perspective-Taking

VITA

Brittany Autumne White was born in Upstate, NY. Her parents, Karolyn White and John and Cindy White, still reside in rural New York. She is the only daughter and youngest of four siblings. She attended Gilbertsville- Mt. Upton Central School in Gilbertsville, NY. She attended Manhattanville College for two years following graduation, before transferring to the State University of New York at Fredonia, where she obtained her Bachelor of Arts degree in Psychology in 2012. While at the State University of New York at Fredonia, Brittany's commitment to social justice began. Following graduation from the State University of Fredonia, Brittany entered the Counseling Psychology Doctoral Program at the University of Tennessee, Knoxville where she was advised by Dr. Joseph R. Miles. While in training at the University of Tennessee, Brittany became passionate about clinical work with underserved populations during her work at the University of Tennessee Psychological Clinic and at Cherokee Health Systems. In the summer of 2018 Brittany will begin an APA accredited, year-long internship at the Veterans Affairs New York Harbor Healthcare System, Manhattan Campus.