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"Maybe These Fields Just Don't Interest Them." Gender and Ethnic Differences in Attributions about STEM Inequities

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ABSTRACT

The current study investigates how undergraduates reason about gender and racial inequity in fields related to science, technology, engineering, and math (STEM). Participants were 342 undergraduates from diverse ethnic backgrounds who answered an open-ended question about ethnic and gender disparities in STEM fields. Thematic analysis revealed substantial variation in how participants reasoned about these disparities. Corresponding quantitative analyses indicated that participants from different sociodemographic backgrounds tended to reason about STEM disparities in different ways. For instance, women were more likely than men to mention stereotyping and lack of confidence as reasons for STEM inequity, whereas men were more likely than women to mention that these disparities are caused by a lack of interest in STEM. In addition, Latinx participants were more likely to mention stereotyping than participants from other ethnic backgrounds. Discussion focuses on potential implications for intervention and outreach efforts.

KEYWORDS

STEM, perceptions of inequality, student attitudes, career choice, narrative

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Despite recent efforts to increase diversity in fields related to science, technology, engineering, and math (STEM), People of Color and women more generally are underrepresented in STEM fields relative to their proportion of the U.S. population (Landivar, 2013; National Science Foundation [NSF], 2018; Schmaling, Blume, Engstrom, Paulos, & De Fina, 2017). When collapsing across ethnic groups, women comprise half of the college-educated U.S. workforce, yet they make up only 29% of the STEM workforce (NSF, 2018). These patterns of underrepresentation are especially acute among Women of Color (American Association of University Women [AAUW], 2010). According to the U.S. Committee on STEM Education (2018), fostering greater ethnic and gender diversity in STEM is important for both economic and humanitarian reasons. From an economic standpoint, for example, workforce diversity is associated with improved innovation and problem-solving capabilities in a world that is increasingly dependent on science and technology (Ostergaard, Timmermans, & Kristinsson, 2011). From a social justice standpoint, it is important to ensure that people from historically marginalized groups have access to STEM careers, given that these careers tend to be high-paying and prestigious.

Although concern about the lack of diversity in STEM fields is well documented among researchers, educators, and policymakers (e.g., NSF, 2018; U.S. Committee on STEM Education, 2018), it is not clear whether this concern extends to students in higher education. This is surprising, given that numerous STEM diversity initiatives and interventions target students at the undergraduate level (see Tsui, 2007). Accordingly, the current research investigates how undergraduates reason about ethnic and gender disparities in STEM fields. Understanding their reasoning will yield actionable insights that can inform more targeted outreach efforts.

Below, we start by explaining why, from a developmental standpoint, it is worthwhile to examine how undergraduates reason about academic inequities. Then we draw from social role theory (Eagly, 1987) to explain how the social context gives rise to role expectations. These role expectations shape stereotypes about People of Color and women in STEM fields; in turn, these stereotypes may inform how people reason about STEM inequities. Next, we summarize three factors—stereotyping, bias, and confidence—that have been linked to STEM inequities in prior research. We were particularly interested in whether participants would reference these empirically grounded constructs when making attributions about ethnic and gender disparities in STEM. Finally, we draw from system justification theory (Jost, Banaji, & Nosek, 2004) and social dominance theory (Sidanius & Pratto, 1999) to discuss whether and how participants' ethnicity and gender may relate to their reasoning about inequities in STEM.

The Developmental Context

The current study focuses on reasoning about STEM inequity among undergraduates. For many students, the undergraduate years coincide with emerging adulthood, which is a developmental period that occurs during the third decade of life (Arnett, 2000). There are several reasons to investigate how emerging adults reason about STEM inequity. First, emerging adulthood is a developmental period of profound growth; it is during this period that many young people explore and solidify their worldviews while also making important decisions about their futures (e.g., career choices; Arnett, 2000; Seiffge-Krenke, Luyckx, & Salmela-Aro, 2014). Thus, the way people reason about societal problems (e.g., occupational disparities) during emerging adulthood likely lays the groundwork for whether and how they will address these problems later in life.

Second, many interventions that focus on fostering diversity in STEM fields target students at the undergraduate level (Tsui, 2007). Yet, research focusing on sociopolitical development suggests that reasoning about societal inequities can vary widely within a given sample (e.g., Watts, Griffith, & Abdul-Adil, 1999). People in the early stages of sociopolitical development are unaware that inequities exist; conversely, people in the later stages are aware of inequities and may even engage in collective action to reduce these inequities (Watts & Abdul-Adil, 1997; Watts et al., 1999; Watts, Williams, & Jagers, 2003). By providing insight into how emerging adults reason about STEM inequities, findings from the current study will enable researchers to design more targeted interventions that take into account students' level of sociopolitical development.

Occupational Expectations and the Social Context

People's beliefs about STEM inequity are embedded in a social context that fosters different occupational expectations for members of different groups. Social role theory (Eagly, 1987) provides insight into why this might be the case. This perspective posits that people have deeply rooted expectations about personality attributes that are suitable, or "appropriate," for each gender. In particular, men are expected to be agentic and dominant, whereas women are expected to be communal and nurturant (Eagly, 1987). Additional research suggests that people expect these traits to vary as a function of ethnicity as well (see Koenig & Eagly, 2014). These gender and ethnic role expectations likely play a role in how people reason about inequities in specific occupational domains. For instance, individuals in STEM fields tend to be viewed as highly agentic, successful, and competitive (Carli, Alawa, Lee, Zhao, & Kim, 2016), which are traits that align with traditional White, masculine gender roles. This overlap may help to explain why some individuals are relatively unconcerned about STEM inequities. As detailed later, social dominance theory and system justification theory expand on this possibility.

Common Explanations for Ethnic and Gender Disparities in STEM

An abundance of research has identified potential causes of ethnic and gender disparities in STEM fields (for reviews, see Ong, Wright, Espinosa, & Orfield, 2011; Wang & Degol, 2016). In particular, three social-contextual factors have received a significant amount of attention. More specifically, individuals who pursue career fields that conflict with society's expectations tend to experience *stereotyping*

(Fisher, Wallace, & Fenton, 2000; Gay, 2004), *bias* (Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012; Robnett, 2016), and a resulting erosion of *confidence* (Correll, 2001; Eccles et al., 1989). Accordingly, we were interested in whether participants would mention any of these constructs when reasoning about STEM inequities. We further explain each of the three constructs below.

Stereotypes. STEM has historically been stereotyped as a "male" domain, such that individuals tend to believe that math and science ability come more naturally to men than to women (Carli, Alawa, Lee, Zhao, & Kim, 2016; Kuchynka et al., 2018; Smyth & Nosek, 2015). Indeed, research demonstrates that even young girls and boys have views consistent with traditional gender roles and stereotypes. For instance, girls believe they are worse at math and science than their male counterparts (Freedman-Doan et al., 2000). Similarly, People of Color commonly report encountering stereotypes that question their intelligence, ability, and qualifications in STEM (Fisher et al., 2000; Gay, 2004). Other research shows that ethnic minority youth are aware of negative racial stereotypes surrounding their intellectual ability (Kellow & Jones, 2008), and that children's endorsement of these ability stereotypes seems to increase with age (Rowley, Kurtz-Costes, Mistry, & Feagans, 2007). Moreover, repeated exposure to these negative stereotypes may contribute to heightened awareness of discrimination among People of Color and women more generally (Brown & Bigler, 2004, 2005; Inman & Baron, 1996).

Systemic Bias. Despite the existence of negative stereotypes, some individuals from marginalized groups nonetheless persist in STEM. Unfortunately, research indicates that they may encounter bias as they work toward STEM degrees and careers. For instance, in one study, 52% of adolescent girls reported experiencing academic sexism in science, math, or computer technology (Leaper & Brown, 2008). Similarly, another study demonstrated that the majority of women in STEM majors and graduate programs had experienced at least one instance of academic sexism in the past year (Robnett, 2016). Hiring discrimination in STEM is also common for women (Moss-Racusin et al., 2012) and People of Color (Quillian, Pager, Hexel, & Midtboen, 2017). Women are half as likely as men to be hired for a math-intensive job, which may be in part because employers expect reduced math performance from women (Reuben, Sapienza, & Zingales, 2014). Those few women who are hired into STEM still face barriers to success in their careers. For instance, female STEM faculty members are less likely than their male counterparts to believe that their departments view them as productive; they also simultaneously report experiencing higher amounts of discrimination when compared to men (Blackwell, Snyder, & Mavriplis, 2009). These issues may be particularly acute for Women of Color, who cite low belongingness and discrimination as key challenges (for a review, see Ong et al., 2011).

Confidence. Confidence is broadly defined as one's self-perceived likelihood of success in specific domains (Lent, Brown, & Gore, 1997; Moakler & Kim, 2014). Experiencing negative stereotypes and systemic bias in STEM over time can erode confidence among People of Color as well as girls and women more generally (e.g., see Robnett, 2016). For instance, girls' confidence in their science and math abilities begins to decline as early as middle school (Eccles et al., 1989). In high

school, girls regularly underestimate their own math ability, despite performing comparably to their male counterparts (Correll, 2001). This low confidence persists for college women in STEM, as they tend to judge themselves more harshly than do men in STEM (Litzler, Samuelson, & Lorah, 2014; Robnett & Thoman, 2017). Similarly, Students of Color in STEM express lower confidence than do White students. For example, a lack of role models and peers from similar backgrounds is associated with feelings of exclusion in STEM among People of Color, which appears to erode their confidence (Litzler et al., 2014; see also Marra, Rodgers, Shen, & Bogue, 2009).

Sociodemographic Variation in Reasoning about Ethnic and Gender Disparities in STEM

In addition to examining how emerging adults reason about inequity in STEM fields, the current study also examines whether participants' reasoning varies according to their ethnicity or gender. System justification theory (SJT; Jost, Banaji, & Nosek, 2004; Jost & Hunyady, 2005; Jost, Kay, & Thorisdottir, 2009) offers an explanation for why both dominant and subordinate groups tend to justify current social systems. SJT suggests that individuals are motivated to perceive the systems that exert control over their lives as legitimate. When presented with social inequities – particularly those that seem impossible to change – they are motivated to rationalize them, even if it is to their own disadvantage. As such, dominant groups, such as White men in STEM fields, are motivated to maintain the systems that keep them in power. However, underrepresented groups such as women and People of Color also tend to tolerate and even justify the inequality they experience. Indeed, research has found that people have a tendency to create attributions that "explain away" stereotype-inconsistent information as a way to maintain common stereotypes (e.g., Sekaquaptewa, Espinoza, Thompson, Vargas, & von Hippel, 2003).

In comparison, social dominance theory (SDT) purports that dominant groups are more likely to endorse hierarchies that legitimize the status quo because it is directly to their benefit (Sidanius & Pratto, 1999). Low-status groups are often stereotyped as incompetent or unambitious, whereas high-status groups are stereotyped as intelligent and successful; these stereotypes justify social hierarchies that maintain high-status groups (Cuddy, Fiske, & Glick, 2007). According to SDT, men may feel the need to justify issues like sexism and bias against women in order to maintain STEM as a male-dominated field. For instance, research shows that boys and men are generally less aware and more skeptical of sexism and bias in STEM fields than are girls and women (Becker & Swim, 2011; Robnett & John, 2018). Similarly, Moss-Racusin, Molenda, and Cramer (2015) found that men were more likely than women to perpetuate or justify sexism against women in STEM. Other research has found that men are more likely than women to justify the existence of sexism and bias against women in an effort to uphold their own status (Morton, Postmes, Haslam, & Hornsey, 2009). Thus, whereas SJT suggests that members of all groups will be motivated to rationalize disparities in STEM fields, SDT indicates that this tendency will be particularly common among members of dominant groups.

Reasoning About STEM Inequities

Social role theory, system justification theory, and social dominance theory all offer insight into factors that may shape how undergraduates reason about STEM inequities. However, relatively little research has examined the specific explanations undergraduates provide for patterns of ethnic and gender underrepresentation in STEM. Moreover, it is not clear whether undergraduates from different sociodemographic backgrounds will reason about STEM inequity in different ways. Extant literature on individual variation in thoughts about STEM inequities is primarily focused on gender. For instance, in a study focusing on adolescents, Robnett and John (2018) found that girls were more likely than boys to perceive sexism in STEM as pervasive and serious. This is consistent with the idea that those with high status (e.g., boys) tend to downplay issues of inequity and justify current systems, which is a core premise of SDT. Beyond adolescents, Cundiff and Vescio (2016) examined undergraduates' attributions for gender disparities in STEM. They found that attributions varied as a function of stereotype endorsement, such that students who strongly endorsed gender stereotypes were less likely to attribute gender disparities in STEM to discrimination. These findings are aligned with both SRT and SJT, which suggest that role expectations and stereotypes encourage the justification of the current hierarchies in STEM. This may be particularly the case among members of dominant groups.

CURRENT STUDY

The current study builds on prior work by investigating how emerging adults reason about ethnic and gender disparities in STEM fields. Specifically, the current study is guided by two overarching research questions. Our first research question (RQ1) is as follows: *How do participants reason about ethnic and gender inequity in STEM fields?* As detailed earlier, prior research consistently links stereotyping, bias, and confidence to STEM inequities. As such, we expected that at least some participants would mention these constructs in their responses. However, we also anticipated that participants would reference additional constructs that have received less empirical attention. Accordingly, our coding approach incorporated both deductive and inductive elements with the goal of capturing the full scope of participant responses.

Our second objective is guided by system justification theory and social dominance theory in an effort to explore sociodemographic variation in how individuals reason about STEM inequity. For instance, research suggests that certain stereotypes are associated with the motivation to justify current systems and social inequities (see Oldmeadow & Fiske, 2007 for a review). As such, explanations for inequities in STEM may vary by perceiver demographic variables – such as gender or ethnicity – that are associated with status and representation in the field. Hence, our second research question (RQ2) is as follows: *To what extent is there ethnic or gender variation in how participants reason about STEM inequity*?

We addressed these research questions via a blend of qualitative and quantitative data (i.e., a mixed-methods approach), which has several advantages over exclusively qualitative or quantitative approaches. For instance, a mixed-methods approach can provide insight into *how* participants reason about a given question,

rather than simply measuring whether they agree or disagree (Creswell, 2009). This approach also leverages the strengths of both quantitative and qualitative data, thus enabling the investigation of a more complex range of issues (Johnson & Onwuegbuzie, 2004).

METHOD

Participants

A total of 342 undergraduates from a large public university in the Southwestern United States participated during the 2017-2018 academic year. Demographic information about the sample is summarized in Table 1. The sample had a mean age of 20.4 years (*SD* = 3.67). With respect to gender, the sample included 195 women (57%) and 135 men (39%); one participant (<1%) identified as non-binary, and 11 participants (3%) did not disclose their gender. With respect to ethnic background, 112 participants (33%) identified as White, 84 (25%) identified as Hispanic/Latinx, 65 (19%) identified as Asian/Pacific Islander, 38 (11%) identified as African-American, 29 (8%) identified as Other, 2 (<1%) identified as Native American, and 12 participants (3%) did not disclose their ethnic background. In terms of major, 125 (37%) participants identified as STEM majors. In this case, STEM majors included biological sciences, chemistry, physics, geoscience, agricultural and environmental science, engineering, computer science, and mathematics. This list is generally consistent with how the National Science Foundation (NSF) defines STEM fields, although social sciences were excluded from STEM in the current study. Correspondingly, 217 (63%) of participants identified as non-STEM majors, which included all other majors not mentioned in the STEM category.

Procedure

The current study originates from a larger project that focuses on constructs such as math anxiety and stereotype threat. After providing informed consent, participants completed an online survey that included a variety of closed- and open-ended questions as well as a demographics questionnaire. Upon completion of the survey, participants were compensated with one research credit for their introductory psychology course.

Measures and Qualitative Coding

To examine how participants reason about STEM inequity, we asked them to respond to the following open-ended question: "White men are overrepresented in science, technology, engineering, and math (STEM) fields. This means that women and People of Color are underrepresented. What do you think about this?" This question was intentionally broad to avoid leading participants toward any particular response.

Participants' responses were coded using thematic analysis, which is a qualitative technique used to identify patterns, or "themes," within a given dataset. Our approach to thematic analysis was informed by the steps outlined in Braun and Clarke (2006). Specifically, after thoroughly reading the full body of data several times, the lead author used a hybrid deductive-inductive approach to develop a coding manual. That is, coding was informed by prior research on stereotyping,

bias, and confidence (i.e., a deductive approach), but we also coded for emergent themes (i.e., an inductive approach).

Table 1: *Overview of Demographic Frequencies in Sample*

Demographic	***n***	**Percentage (%)**
Gender		
Male	135	39%
Female	195	57%
Nonbinary	1	<1%
Undisclosed	11	3%
Ethnicity		
White	112 (63% Female)	33%
Hispanic/Latinx	84 (63% Female)	25%
Asian/Pacific Islander	65 (43% Female)	19%
African-American	38 (61% Female)	11%
Other	29 (66% Female)	8%
Native American	2 (100% Female)	<1%
Undisclosed	12 (8% Female)	3%
Age		
18-25	310	91%
25+	21	6%
Undisclosed	11	3%
Major		
STEM Major	125	37%
Non-STEM Major	217	63%
Year in School		
First Year	137	40%
Second Year	84	25%
Third Year	71	21%
Fourth Year	34	10%
Other	4	<1%
Bachelor's Degree	2	<1%
Undisclosed	10	3%

The coding manual was composed of two overarching themes, both of which contained four subcategories (see Table 2). The subcategories within each theme were not mutually exclusive. That is, responses with content pertaining to more than one subcategory were grouped into each relevant subcategory. Nearly a quarter (n = 64, 24%) of the responses fell into more than one subcategory within a given theme. Only two responses (<1%) fell under three or more categories. Responses that mentioned a subcategory multiple times were not coded multiple times. For example, if a participant mentioned "lack of interest" four times in their response, the response was only coded once for that subcategory.

Table 2: *Overview of Participants' Reasoning About Whether STEM Inequity is a Serious Problem*

Themes and Coding Categories	Sample Responses	Percentage of Codable Responses %
STEM Inequity Is a Problem		**75%**
Fairness	"I think that everyone deserves a chance to be a part of a field of their interest. I don't think that anyone deserves to be or should be underrepresented in anything."	40%
Systemic Bias	"I think it is because of the funds and money white families have. It lets the men have a good education."	30%
Stereotyping	"I think the stereotype that men are better in these fields makes women less likely to go into these fields because they believe that stereotype. I think women are just as capable as men to be represented in these fields, but it is common for people to conform to stereotypes."	16%
Confidence	"I do not think that it has anything to do with who has more brains. I believe it is because white men are more confident and will not be looked at the way colored women would be."	7%
STEM Inequity Is Not a Problem		**25%**
Lack of Interest	"Well, being there are more white males in general that makes sense, but also you need more people that are on the underrepresented side to be interested in those subjects."	11%
Merit-Based	"I think as long as those who are fit for the job receive the job, there should not be any problems with that."	8%
STEM is Diverse	"I find this very odd because I have noticed an increasing number of diversities in those areas."	5%
Not Unique to STEM	"This reflects broader institutional racism and sexism, which is not particular to STEM fields."	2%

Overall, 219 responses (64%) could be classified according to the coding manual. Responses were classified as "not codable" when they were incoherent, failed to address the prompt, or raised idiosyncratic issues that were not mentioned by other participants. For example, one participant wrote, "Women and People of Color already in STEM fields should help fellow youth that are underrepresented across the world." Another participant simply wrote "True." These and similar responses are not further considered in the forthcoming analyses.

Inter-rater reliability was tested by having two trained research assistants and the lead author code 60 participant responses separately. All coders then met to revise and refine the coding manual. Disagreements were resolved through consensus. After revision, responses were again coded by the lead author and research assistants separately before reconvening to calculate inter-rater reliability, which was indexed by Cohen's kappa. Reliability was computed separately for each theme. The two undergraduate coders had an acceptable level of agreement with one another for both of the themes (*k* range: .85 to .91). Similarly, both of the reliability coders had an acceptable level of agreement with the lead author for both themes (*k* range: .87 to .92).

RESULTS

Findings from the current study are presented in two sections. We begin by describing the qualitative findings that address RQ1, which asked how participants reason about ethnic and gender disparities in STEM fields. As summarized in Table 2, the qualitative data are broadly grouped into two themes according to whether participants perceived STEM inequity as a problem. These themes are then further subdivided into several more specific coding categories. Second, we present quantitative analysis pertaining to RQ2, which asked whether reasoning about STEM inequity varies as a function of participants' ethnicity or gender.

Qualitative Analysis

Theme 1: STEM inequity is a problem. Theme 1 was composed of responses that acknowledged inequity in STEM and subsequently listed factors that participants believed to contribute to the inequity. Three-quarters of codable responses (*n* = 165, 75%) fell under Theme 1. Responses that fell under this theme were coded into at least one of four possible subcategories: *fairness, systemic bias, stereotypes*, and *confidence*.

Fairness. Responses in this category (*n* = 87, 40%) highlighted fairness and representation in STEM fields. Participants who were coded into this category tended to view STEM equality as necessary and considered inequity to be a major problem. For example, Blair noted: "I believe that [STEM inequity] needs to change because White men aren't the smartest and women and People of Color are just as smart and/or smarter."

Systemic Bias. Responses in this category (*n* = 66, 30%) tended to mention that White men receive more resources (e.g., better environments, better schooling, more money) and/or opportunities (e.g., better job offers, scholarships) than do

women and People of Color. For example, Taylor remarked: "I believe that the opportunities presented for White men within the STEM fields are much easier to come by and to take advantage of, [whereas] women and People of Color have to work harder for less opportunities."

Stereotypes. Responses in this category (*n* = 34, 16%) made note of positive stereotypes for White men and/or harmful stereotypes for women and People of Color in STEM. For example, Alex wrote: "People don't expect women to have jobs that include science as much as society does for men. I think women need to be brought up with the thoughts in their head that they can be in STEM fields and be successful."

Confidence. Responses in the final subcategory for Theme 1 (*n* = 16, 7%) mentioned that White men have more confidence when pursuing STEM careers, and/or that women and People of Color have less confidence or feel more pressure to succeed in STEM. For example, Riley noted: "It's extremely unfair because the people who are underrepresented don't feel as though they can succeed in these fields or they have a lot of potential obstacles in their path to get there."

Theme 2: STEM inequity is not a problem. Theme 2 was composed of participants who did not perceive STEM inequity as a problem. One quarter (*n* = 55, 25%) of the sample provided responses that fell under Theme 2. Responses that fell under this theme were also coded into at least one of four possible subcategories: *lack of interest, merit-based, STEM is diverse,* and *not unique to STEM*.

Lack of interest. Responses in this category (*n* = 24, 7%) indicated that women and People of Color simply are not interested in or do not have the motivation to pursue STEM fields. For example, Robin wrote: "I am a little shocked but not so much, girls seem to maybe focus on more girly jobs or [ones that are] less technical."

Merit-based. Responses in this category (*n* = 18, 5%) reflected that STEM positions should not be given to individuals simply because they identify with an underrepresented group. Responses in this category most often indicated that the "best-qualified person" should work in STEM. For example, Avery noted: "I believe that women and People of Color should be represented for their accomplishments and not what they look like. One cannot give praise for work based on looks."

STEM is diverse. Responses in this category (*n* = 10, 3%) most often indicated that, based on their personal experiences, STEM fields are already diverse, with respect to both gender and ethnicity. For example, Charlie remarked: "From prior experiences there are a variety of individuals in the STEM fields. Doctors, for example, are … diverse."

Not unique to STEM. Responses in the final subcategory for Theme 2 (*n* = 5, 2%) tended to acknowledge the inequity in STEM, but did not find it particularly concerning because other career fields also have inequity. Although one interpretation of this category could be that the participants are concerned about

inequity in all fields—not just in STEM—the tone of these responses often conveyed feelings of indifference about correcting these inequities. For example, Elliot noted:

> "If you mean that women and People of Color are not prevalent in the fields of science, technology, engineering, and math, then I see no problem with that. There are more women [than men] in the field of nursing, but should we complain about it? Not really."

Quantitative Analyses

A series of chi-square analyses provided insight into RQ2, which asked whether participants who differed on the basis of ethnicity and gender reasoned in different ways about STEM inequity. Findings are summarized in Tables 3 and 4.

Table 3: *Overview of Chi-Square Results by Ethnicity*

	Total *N* = 179		**White**		**Asian**		**Latinx**		
	n	***%***	***n***	***%***	***n***	***%***	***n***	***%***	***χ2***
Theme 1									
Fairness	72	40	35	20	18	10	19	10	2.28
Systemic Bias	49	27	25	14	10	5	14	8	.642
Stereotyping	32	18	11	6	4	2	17	10	7.77*
Confidence	14	8	6	3	3	2	5	3	.92
Theme 2									
Lack of Interest	19	11	9	5	2	1	8	5	1.77
Merit-Based	13	7	8	4	3	2	3	1	1.97
STEM is Diverse	9	5	3	2	5	3	1	<1	6.93
Not Unique to STEM	4	2	2	1	0	0	2	1	1.27

Note. $*p < .05$, $** p < .01$.

Table 4: *Overview of Chi-Square Results by Gender*

	Total *N* = 217		**Males**		**Females**		
	n	***%***	***n***	***%***	***n***	***%***	***χ2***
Theme 1							
Fairness	86	40	33	15	53	25	.175
Systemic Bias	65	30	26	12	39	18	.000
Stereotyping	34	16	7	3	27	13	6.39*
Confidence	16	7	2	1	14	6	5.48*
Theme 2							
Lack of Interest	24	11	16	7	8	4	7.93**
Merit-Based	18	8	7	3	11	5	.012
STEM is Diverse	10	5	5	2.5	5	2.5	.428
Not Unique to STEM	5	2	4	2	1	<1	3.39

Note. $*p < .05$, $** p < .01$.

Prior to conducting the analyses, we omitted the response from the nonbinary participant in order to meet cell size requirements. Along the same vein, we were only able to test for variation across the three largest ethnic groups: White, Asian/Pacific Islander, and Latinx. Finally, we omitted three responses from participants who mentioned subcategories related to both overarching themes.

Ethnic variation. Findings did not reveal significant ethnic variation in the subcategories of *fairness, systemic bias, confidence, lack of interest, merit-based, STEM is diverse,* or *not unique to STEM*. Findings did, however, illustrate that Latinx participants were significantly more likely than White or Asian/Pacific Islander participants to mention *stereotyping* in their responses, ($\chi 2$ (2, N=179)=7.772, p=.021, V=.208). Most of these responses focused on positive stereotypes ascribed to White men.

For example, Sofia, a Latina woman, wrote, "I agree with the statement made. It all comes down to women and People of Color being underestimated to complete these tasks and being capable of doing something a White man is expected to do." April, another Latina woman, wrote: "…Women have been always seen as the stay at home parent that should choose "easier" fields to major in." Similarly, Nicole, a Latina woman, wrote: "I think it is expected that White men are good at STEM and women and People of Color are not so good at it." Importantly, these sentiments were not limited to women. For example, Sergio, a Latino man, expressed:

> "I think it's [a] stereotype where the White men are seen as the people that would get involve[d] in any math applied field while women and People of Color are seen as getting involved [in things other than] math."

Gender Variation. Findings did not reveal significant gender variation in the subcategories of *fairness, systemic bias, merit-based, STEM is diverse,* or *not unique to STEM*. Findings did, however, illustrate that men were significantly less likely than women to mention *stereotyping* ($\chi 2$ (1, N=217)=6.385, p=.012, V=.172) and *lack of confidence*, ($\chi 2$ (2, N=217)=5.475, p=.019, V=.159) as issues that impacted women and People of Color in their pursuit of STEM careers. Participants providing these responses mentioned personal struggles as well as long-standing societal trends. For instance, with respect to stereotyping, Jennifer, a White woman, wrote, "Growing up, everyone is told that boys are better at math, and I have just [grown] up accepting this lie I was told." Elena, a Latina woman, elaborated on how society upholds harmful stereotypes:

> "I think this is due to how our society views gender roles and race. Women in STEM fields have been kept back due to gender and they can be just as capable as men in these fields. I think that to get more women into STEM fields we must work on the gender roles of society."

Other women focused more on confidence. For example, Laura, a Latina woman, speculated that "White men would probably have the most confidence while applying for jobs or positions and would not be as scrutinized [as to] whether or not

they have the abilities in the first place." Lynne, an Asian American woman, provided a similar response: "I do not think that it has anything to do with who has more brains. I believe it is because White men are more confident and will not be looked at the way a [Woman of Color] would be."

In contrast, men were significantly more likely than women to reference *lack of interest* as a reason for STEM inequity ($\chi 2$ (1, N=217)=7.934, p=.005, V=.191). Participants often framed this lack of interest as an incidental contributor to inequity in STEM. For example, Lucas, a Latino man, wrote, "Maybe a great number of White [men] might like these subjects a lot more. It does not mean White [men] are better than women and other People of Color." Likewise, Dylan, a White man, remarked that "Women choose different career paths from men. It's not because they cannot get hired in those fields. It's because they don't want to be; it's because they want to go into other fields." Logan, a White man, spoke from personal experience:

> "I think that it is true due to the fact that many of the White men I know are pursuing careers in those fields. On the other hand, while I have minority friends who are interested in these fields, I have yet to meet a female on campus that is majoring in technology, engineering, or mathematics."

DISCUSSION

The current study provides novel insight into how emerging adults reason about ethnic and gender inequities in STEM domains. Findings revealed that participants varied widely in how they reasoned about STEM inequities. As discussed below, the themes that emerged in participants' responses can inform the development of targeted interventions aimed at increasing diversity in STEM. Consistent with social dominance theory, findings also showed that men were more likely than women to rationalize STEM disparities by focusing on a lack of interest, whereas women were more likely than men to express concern about STEM inequity. Below, we elaborate on these findings and conclude by describing limitations and future directions for research.

Overview of Key Findings

Our coding categories were sorted into two overarching themes—*STEM inequity is a problem* and *STEM inequity is not a problem*—that each had four subcategories. Within *STEM inequity is a problem,* the four subcategories were *fairness, systemic bias, stereotyping,* and *confidence.* Within *STEM inequity is not a problem*, the four subcategories were *lack of interest, merit-based, not unique to STEM,* and *STEM is diverse*. In line with prior research focusing on common causes of ethnic and gender disparities in STEM, we expected participants to mention stereotyping (Carli et al., 2016; Fisher et al., 2000; Gay, 2004; Kuchynka et al., 2018; Smyth & Nosek, 2015), systemic bias (Leaper & Brown, 2008; Reuben et al, 2014; Robnett, 2016), and confidence (Bandura, 1977; Correll, 2001; Eccles et al., 1989; Robnett & Thoman, 2017).

In contrast, several of the emergent coding categories were unexpected. For instance, we were also surprised that some participants mentioned that STEM is already diverse, given that we explicitly highlighted the lack of diversity in STEM within the question prompt. In addition, responses that mentioned inequity as not being unique to STEM were unexpected. Given that much of the literature on STEM inequity is focused on sexism (e.g., Leaper & Brown, 2008; Robnett, 2016), we were surprised to find that sexism was not explicitly mentioned in the majority of participant responses. Relatedly, given the abundance of extant literature on agentic versus communal values and their relation to career choice (e.g., Evans & Diekman, 2009), we were surprised that participants did not mention these types of values in their responses. However, it is possible that individuals who attributed ethnic and gender disparities to a lack of interest were influenced by group-based expectations about agentic and communal traits.

Gender Variation. Findings revealed key gender differences in how undergraduates reason about STEM inequities. Specifically, women were significantly more likely than men to mention stereotyping and low confidence as issues that contribute to the gender and ethnic gap in STEM. These results complement research indicating that negative stereotypes about women's math ability can reduce women's identification with STEM domains and lower their motivation to pursue STEM careers (Cundiff, Vescio, Loken, & Lo, 2013; Starr, 2018). The results of the current study also add to a growing body of evidence that cite confidence as integral to the success of girls and women in STEM (Cech, Rubineau, Silbey, & Seron, 2011; Schmader, Johns, & Barquissau, 2004; Stake & Mares, 2001). More specifically, prior research suggests that girls and women – even those who pursue STEM majors – tend to report lower academic confidence than do men with comparable academic performance (Litzler et al., 2014; Moakler & Kim, 2014; Robnett & Thoman, 2017). In contrast, men were significantly more likely than women to mention a lack of interest from women and People of Color as a contributor to inequity in STEM. This finding aligns with social dominance theory (Sidanius & Pratto, 1999), such that men may justify the status quo by referencing lack of interest in the field as opposed to social justice issues that would necessitate action for change. In other words, if women and People of Color are simply not interested in STEM, then the current inequities in STEM are not a problem and are not worth addressing.

Our findings also indicate that for some participants, attributions for STEM inequities are shaped by stereotypes and other socio-cultural factors, as purported by social role theory (Eagly, 1987). More specifically, women may feel pressure to show less interest in careers that do not align with what is stereotypically perceived as "female." In addition, men are expected to have "innate talent" in math and science, whereas women are not (Leslie, Cimpian, Meyer, Freeland, 2015; Mascret & Cury, 2015; Rattan, Good, & Dweck, 2012; Starr, 2018). These gendered stereotypes and expectations do not go unnoticed, as women are more likely than men to perceive sexism and discrimination (Brown & Bigler, 2004; Hayes & Bigler,

2012; Robnett & John, 2018). Indeed, they may help explain why women are more likely to generate stereotype-based explanations for STEM inequities.

Ethnic Variation. Findings from the current study also revealed that Latinx participants were significantly more likely to mention stereotyping than were White or Asian American participants. Although Latinx and Asian American students are collectively considered "People of Color," Latinx students are negatively stereotyped in STEM domains (Gandara & Contreras, 2010), whereas Asian American students are positively stereotyped (Lee, 1994; Trytten, Lowe, & Walden, 2012). In addition, Latinx people are underrepresented in STEM relative to their proportional representation in the U.S. population, whereas Asian American people are overrepresented. Specifically, Asian American people hold 17.4% of STEM occupations, yet make up only 5.7% of the U.S. population. By comparison, Latinx people hold 6.1% of all STEM occupations, but make up nearly 18% of the U.S. population (NSF, 2018; US Census Bureau, 2017). These statistics, in addition to the variation in stereotype content regarding Asian and Latinx students, may help to explain why Latinx participants were particularly likely to mention stereotyping. More specifically, individuals from underrepresented ethnic groups who are targeted by stereotypes and experience discrimination tend to be more perceptive of stereotypes and prejudice (Brown & Bigler, 2005). For instance, Black and Latinx people are more likely than White individuals to report experience with discrimination and are more likely to report bias from others (see Brown, 2006).

Our findings pertaining to ethnic variation are also consistent with prior research showing that Latinx students are more likely than students from other ethnic groups to express concern about stereotyping and leave a STEM major in order to avoid stereotyping (McGee, 2016). Further, prior work indicates that negative stereotypes might be particularly harmful for Latina girls and women. For example, when examining what it meant to be "scientific" in a sample of fourth grade students, Carlone, Haun-Frank, and Webb (2011) found that Latina girls were among the students who least identified as "smart science [people]," despite performing comparably to their White classmates in science. In addition, Brown and Leaper (2010) found that Latina adolescents' math self-efficacy was more negatively impacted by stereotypes about women's math and science ability than the math self-efficacy of White adolescent girls. More generally, our findings are consistent with extant research suggesting that discrimination is more apparent when directed at groups who do not benefit from favoritism (Rodin, Price, Bryson, & Sanchez, 1990; Verkuyten, 2002). That is, Latinx students tend to be negatively stereotyped in STEM realms (Gandara et al., 2010), and as such may perceive more discrimination in these fields relative to students from other ethnic groups.

Implications for Intervention. Our findings may be useful to scholars who design interventions that aim to foster greater equity in STEM fields. According to Watts and colleagues' (2003) theory of sociopolitical development, individuals progress at different rates through various stages of acquiring the knowledge, skills, and emotional intelligence to act against oppressive social systems. Consistent with this premise, participants in the current study varied widely in how they reasoned about STEM inequity. Accordingly, interventions that aim to foster greater STEM equity at

the undergraduate level may be more effective if they take into account students' level of sociopolitical development. For example, some of the participants in the current study were unconcerned about STEM inequities and seemed unaware of systemic biases that women and People of Color encounter in STEM fields. These students may benefit from interventions designed to simply raise their awareness of inequity, bias, and their societal implications. In contrast, other participants had a fairly sophisticated understanding of STEM inequities and their potential causes. These individuals could be targeted with interventions that encourage action to reduce inequity (e.g., sensitivity training, structured mentoring programs or support groups).

Limitations and Future Directions

The current study should be interpreted in light of several limitations. First, analyses were limited by sample size. A larger sample would allow for analyses examining how reasoning varies by gender and race simultaneously. This type of intersectional analysis would allow researchers to probe subgroups of particular interest (e.g., Latina women; Crenshaw, 1991; Else-Quest & Hyde, 2016). Future research should also obtain data from individuals who do not identify as gender-binary (e.g., trans men and women, gender fluid individuals). The opinions of a nonbinary or transgender individual could differ significantly from those of a cisgender person, as their experiences with gender roles, expectations, and stereotypes are likely different. Understanding how non-binary individuals reason about inequities in STEM is a crucial component in understanding broader issues of diversity in the field.

Another limitation of the current study is that we did not examine whether participants' response patterns differed by college major. Whereas the STEM workforce has nearly reached gender parity in some fields (e.g., life sciences), math-intensive STEM fields such as physics and astronomy are only 11% women (NSF, 2018). Similarly, although People of Color are underrepresented as a whole across STEM fields, there is significant ethnic variation in patterns of representation in specific STEM subfields (NSF, 2018). Given that ethnic and gender disparities fluctuate from one STEM field to the next, it is plausible that participants in different majors would have different perspectives on STEM inequity.

Next, data were collected from a single university in the U.S. Thus, findings may not generalize to emerging adults from other parts of the U.S. or other countries. Moreover, the sample was largely composed of undergraduates who were early in their college careers. Future research should investigate the thoughts and reasoning processes of college students who are further along in their majors, as they will have had more time and experience navigating the college environment.

Another limitation lies in the wording of our open-ended prompt. Although the wording of the prompt was intentionally broad to avoid priming, it is possible that we would have obtained more specific information if we had phrased the question differently. For example, it would have been interesting to ask participants about their thoughts regarding agentic and communal values in relation to STEM career attainment. Relatedly, explicitly asking participants about their personal

experiences with stereotyping, bias, and low confidence would have provided meaningful information. Although many participants mentioned topics such as confidence or stereotyping when reasoning about inequity in STEM fields, we cannot make inferences about their actual experiences with these challenges. In other words, findings from the current study do not provide insight into whether participants' responses were grounded in personal experience versus more general observations about the world.

A final limitation to the current study is the cross-sectional nature of the data. A longitudinal study that follows students over the course of their entire college career would provide compelling insight into whether their thoughts about STEM inequity change over time. Further, a longitudinal design would also provide insight into whether certain response patterns (e.g., expressing concern about systematic bias in STEM) are associated with action to change the STEM climate. Such a design would facilitate the development of interventions that focus on (a) increasing confidence for women who want to pursue STEM, (b) reducing instances of stereotyping within higher education, and (c) promoting initiatives that educate college students about the importance of diversity and inclusion in the STEM workforce.

CONCLUSION

The current study not only examines how undergraduates reason about STEM inequities, it also sheds light on how reasoning differs according to participants' ethnicity and gender. Findings replicate and extend existing research in several ways. For instance, with respect to ethnicity, findings suggest that stereotyping may be a unique concern for people from Latinx backgrounds when compared to people from White and Asian American backgrounds. With respect to gender, women's mentions of stereotyping and low confidence reinforce a large body of research documenting these challenges for women who are currently in STEM fields. From a theoretical standpoint, findings are consistent with social role theory, such that widely-held societal expectations for what people "should" do can reinforce stereotypes and biases that impose both real and perceived limits on certain groups, such as women and People of Color. Findings are also consistent with social dominance theory. Specifically, men were more likely than women to explain that patterns of inequity in STEM are caused by different interests that steer members of marginalized groups toward fields other than STEM. Collectively, findings illustrate that individuals from diverse backgrounds have distinct concerns about STEM inequity. Understanding these concerns is a vital component of developing targeted interventions that promote greater diversity in STEM fields.

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