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ORIGINAL ARTICLE

Solidarity in STEM: How Gender Composition Affects Women's Experience in Work Teams

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Abstract

The relationships among the percentage of women in a team and women's sense of team identification and collective efficacy as well as team performance was examined. We explored these relationships in a sample of student teams conducting a semester-long social science research project within the context of science and technology-focused university. Findings with 95 U.S. college students (43 women) show that women experience higher team identification and collective efficacy as the percent of women teammates increases. Additionally, women's team identification and collective efficacy mediate the relationship between the percentage of women on the team and overall team performance. Interestingly, the number of men on the team did not influence men's sense of team identification, collective efficacy, or team performance. This research has implications for team composition. Specifically, when navigating diversity in teams, managers and leaders should aim to build teams that are composed of multiple women versus an approach that divides women up among various teams. In doing so, managers can better secure conditions for the development of positive teamwork experiences and, ultimately, performance.

Keywords Gender equality · Identification · Collective efficacy theory · STEM · Team composition

Tackling complex problems in organizations requires the effort of multiple people working together toward optimal solutions (Jones 2009; Wuchty et al. 2007). Despite the growing trend toward teamwork—particularly in scientific and technical fields—women account for a small percentage of this male-dominated workforce (Wright et al. 2015). For example, women hold just 14.7% of board seats globally (Catalyst 2017) and account for only 24% of STEM workers (Beede et al. 2011). Although the underrepresentation of women is not a new phenomenon (Catalyst 2017; Dolan 1997; Heilman and Eagly 2008; Lewin and Duchan 1971; Shih 2006; Wright et al. 2015), the shift from individually-oriented work to teamwork has highlighted the gender imbalance (Bear and Woolley 2011; Hoogendoorn et al. 2013) and the need to focus on women's issues in research (Eagly et al. 2012). Women are consistently underrepresented as they work in teams with their colleagues, often making teams a gendered context for women (Johns 2018). Importantly, this may have implications for team dynamics and performance (Nielsen et al. 2017; Woolley et al. 2010; Woolley and Malone 2011) because women tend to suffer disadvantages in male-dominated contexts (Eagly and Carli 2003).

Although many have acknowledged the importance and scarcity of women in scientific and other intellectual fields, our understanding of their experiences remains quite limited. In particular, men and women are often equally competent (Cheryan et al. 2017; Dasgupta et al. 2015), but they do not seem to have the same experience of teamwork. For example members of mixed-gender teams rated themselves as being less effective than members of all-male teams (Baugh and Graen 1997), and women participating in a mixed-gender dyad were viewed more negatively when reporting on the dyad's outcomes (Heilman and Haynes 2005). Although alarming in its own right, this trend has become exceptionally problematic in the scientific and technical fields because they are disproportionately male (Hill et al. 2010). The present study seeks to bridge the gap between perception and reality by gaining a better understanding of the experience of teamwork for women in scientific fields. We ask: Does increasing the number of

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women on a team alter their team experience and, in turn, team performance? We begin by addressing the lack of representation in fields such as science and technology, discussing the implications for processes such as team identification and collective efficacy and reviewing the literature with the aim of understanding how to ensure women's participation and success on science teams.

Gender Imbalance in STEM

There are several antecedents and processes that hinder women's participation in the science workforce, and antecedents can begin as early as middle school for some girls. Whereas boys are encouraged to pursue subjects such as science and math, girls are simultaneously discouraged from participating (Acker and Oatley 1993) and their self-efficacy toward science, technology, engineering, and math decreases (Hill et al. 2010). Several studies have suggested that women are less likely to enter the STEM workforce due to low self-efficacy with respect to the relevant fields (Hackett and Betz 1981; Hill et al. 2010; Zeldin et al. 2008; Zeldin and Pajares 2000) and, as a result, the gender distribution in the STEM workforce has become highly skewed (Beede et al. 2011; Shih 2006).

This skewed gender distribution, in turn, enables gender inequality throughout STEM fields. Both Burleigh (2015) and Settles (2014) acknowledged that the STEM fields are dominated by men and riddled with gender discrimination. For example, Moss-Racusin et al. (2012) found that university-level science faculty held preexisting subtle biases against women and, as a result, were less likely to hire prospective women faculty due to a perceived lack of competence. Regarding the perception of women's and men's performance, Heilman and Haynes (2005) found that women were at a disadvantage when working with men on science-related tasks. Specifically, they found that when teams comprised one woman and one man, women were regarded more negatively when the dyad reported on successful dyad outcomes. This was also true for evaluations: Women were rated more harshly than their male counterparts when the dyad was given feedback as a unit (Heilman and Haynes 2005). Taken collectively, these antecedents and processes perpetuate a stereotype that hinders women from engaging in STEM fields. In turn, we see fewer women participating in the sciences and, thus, less participation in the team setting, which is often the landscape of work in STEM fields.

Yet, it is important to note that this lack of participation in STEM fields does not appear to be based on women's lack of ability. There is ample research suggesting that women's intellectual abilities in STEM fields are equal to, or better than, their male counterparts'; rather, social influences and self-perceptions cause women not to engage in science and other technical fields (Betz and Hackett 1997; Catsambis 1995; Hyde et al. 2008). Furthermore, women appear to relate to team members more positively. Eagly (2007) found that women, in contrast to men, benefit teams due to their supportive and encouraging treatment of team members. Men, on the other hand, attended to members' failures to meet standards, avoided problems until they became critical, and were absent or lacked involvement at critical times (Eagly 2007).

However, there is a caveat to this relationship where women are beneficial to the team: Women's scientific abilities tend to become visible when there is a "critical mass" of women present (Etzkowitz et al. 1994, p. 51). Etzkowitz and colleagues (Etzkowitz et al. 1994) discussed the importance of a critical mass of women scientists in academic departments that work interdependently, suggesting that women must come together and support one another in making contributions to the scientific community. Dasgupta and colleagues (Dasgupta et al. 2015) and Joshi (2014) also found support for the idea that women were more likely to participate in science teams when more women were present on the team. The current study explores a similar idea. Specifically, we investigate how the presence of multiple women on a team may positively influence perceptions of team identification and collective efficacy among women and ultimately bolster team performance.

Team Identification

Although previous research points toward the number of women on the team as having an important impact on team performance, we do not yet understand why this may be (Bowers et al. 2000; Dasgupta et al. 2015; Etzkowitz et al. 1994; Joshi 2014). One potential explanation is that greater participation by women increases their positive identification with the team. *Team identification* refers to the degree to which a team member feels as though the team has a unified identity (Earley and Mosakowski 2000) and the degree to which team members connect their self-concept with membership on that team (Hinds and Mortensen 2005). Team identification makes the unifying and/or unique features of the team salient to the group. For example, professional athletic teams often have two sets of uniforms: one they wear when they play at home and another when they play on the road. Something as simple as a uniform serves to increase team identification because they all match and team members can easily identify who is on their team. They also serve to distinguish one team from another, and teams wear "away uniforms" to ensure that their attire is definitively different from that of the home team.

Gender is a particularly salient feature in STEM. However, women may find it difficult to identify with a STEM team because these teams tend to be disproportionately composed of men. Teams that include more women may provide a sense belonging for those women, which can encourage their identification to the team. In their qualitative analysis of women on corporate boards, Konrad and colleagues (Konrad et al. 2008) received this response when they asked a male CEO about a board that increased the number of women on their team from zero to four members:

> As there were more women, the first woman became more active. They were all more active as the number of women increased. It's a group dynamic. When you bring on one of any demographic group, they're trying to figure out how they fit. With more, that's not an issue. They were more vocal, more willing to push their issues when more women were added to the board. More relaxed (Male CEO, p. 146).

Thus, as the number of women increased, the women felt a better and stronger fit with the rest of the team. This, in turn, led to greater participation of women. Furthermore, work on minority identity suggests that when minority members are together, they feel that their identity is more cohesive and strong (Oakes 1987; Tajfel and Turner 1986; van Knippenberg 2000).

On the other hand, men may have a different experience in regard to gender composition. Cohen and Swim (1995) examined gender ratios and self-confidence in teams and found that women who anticipated being the only woman in the group preferred to change groups or change the gender composition of the group. In contrast, men did not differ in their reactions to group composition. Because men are well represented (Beede et al. 2011; Catalyst 2017; Heilman 2001; Shih 2006; Wright et al. 2015) and not particularly affected by being a minority member (Cohen and Swim 1995), we expect that having more men on the team is less relevant to their identification with the team. As such, we hypothesize this effect for women but not for men. Specifically, we propose that as membership of women increases, women's ability to identify with the team also increases (Hypothesis 1).

Collective Efficacy

As team identification increases, members should experience increased feelings of efficacy regarding team performance. *Collective efficacy* is formally defined as "a group's shared belief in its conjoint capabilities to organize and execute the courses of action required to produce given levels of attainments" (Bandura 1997, p. 447) and results from an observation of positive interactions and teamwork behavior (Tasa et al. 2007). Social identity theory supports this idea, suggesting that strong identification leads individuals to attribute positive evaluations to their group (Tajfel 1978). This, in turn, positively influences the belief that the team can be successful at its task (van Knippenberg 2000). In other words, the more similar group members are to one another, the more likely they are to identify with the team and, as a result, work collectively to accomplish the team's goals (Eckel and Grossman 2005; Wang and Howell 2012). Considering these ideas from a woman's perspective, we therefore expect that within a team, women's team identification is likely to positively predict their sense of collective efficacy (Hypothesis 2a).

Furthermore, because we expect that the proportion of women on the team influences women's team identification, we also expect that the proportion of women on the team has an impact on women's collective efficacy through its effect on team identification. Women are often seen as less competent than men in STEM-related work. For example, James Damore, a former engineer at Google, shared a widely discussed memo regarding women's inferior abilities compared to men for technology-based work (Damore 2017). This type of sentiment—that women do not quite belong in STEM fields—perpetuates a stereotype, and instead of feeling connected and empowered by their gender identity, women in STEM teams may feel threatened and underperform (Steele 1997). However, the presence of more women on a team may serve to subvert this negative perception and encourage a sense of collective efficacy through shared identification.

In contrast, these patterns of gender proportions of the team, team identification, and collective efficacy may differ for men engaging in teamwork. Fernández-Ballesteros et al. (2002) found that, compared to women, men had a higher sense of efficacy that their individual efforts could contribute to the group. Additionally, this individual efficacy was shown to contribute substantially to collective efficacy (Fernández-Ballesteros et al. 2002). This is important because men do not experience deterrence from STEM fields the way women do throughout their education and careers (Acker and Oatley 1993; Hackett and Betz 1981; Hill et al. 2010; Zeldin et al. 2008; Zeldin and Pajares 2000). Thus, it is likely that men's individual efficacy will naturally be higher than that of women's. Taken together, the literature suggests a relationship between the proportion of women on a team and their collective efficacy, through women's team identification, and we hypothesize that the proportion of women on the team positively predicts women's collective efficacy through its effect on women's team identification (Hypothesis 2b).

Team Performance

Direct Effect of Collective Efficacy

When members feel confident in their team, they will likely feel increased motivation to perform, which should, in turn, have a positive effect on team performance. Decades of research on teams support the positive association between collective efficacy and team performance (Stajkovic et al. 2009). Little and Madigan (1997) found that collective efficacy predicted team performance in self-managed work teams. Tasa and colleagues (Tasa et al. 2007) examined the development of collective efficacy and found that when teamwork behavior was aggregated, those measures were related to collective efficacy. Furthermore, collective efficacy was a significant predictor of team performance (Tasa et al. 2007). Most recently Huang et al. (2017) found that collective efficacy positively mediated the relationship between team members' learning goal orientation and team performance. In sum, individuals' motivations to contribute to the team were related to the team's belief that they could accomplish their tasks, which predicted overall team performance.

Importantly, this relationship between collective efficacy and team performance may have specific implications for women in organizations, particularly those that are scientific and/or technically focused. Research hints at this idea with findings regarding the number of women in teams and effective team processes. For example, Woolley and her colleagues (Woolley et al. 2010) suggested that teams might benefit from having more women members. The authors studied the capacity for collective intelligence in teams, and their findings demonstrated the collaborative edge that women bring to the team setting: Women were significantly more interpersonally-oriented than men, and all-women teams exhibited more egalitarian behavior (e.g., shared leadership) when compared to all-male teams (Woolley et al. 2010). This finding corroborates previous meta-analytic findings demonstrating a similar pattern in women's leadership styles (Eagly and Johnson 1990; Eagly and Karau 1991). Furthermore, work on team gender composition has found that not only are women more likely to work in teams, but they also are more collaborative than their male counterparts (Bear and Woolley 2011; Lungeanu et al. 2014).

Together, these findings suggest that women's involvement in science teams boosts collaborative efforts as well as group performance. Women's tendencies to be democratic and socially-oriented (Eagly and Johnson 1990; Eagly and Karau 1991) point toward a social-role difference in which women rely on one another to accomplish tasks (Eagly 1987; Eagly et al. 1995). We align collective efficacy along with the democratic, social, and collaborative elements that previous research has attributed to women and team effectiveness to suggest that women's sense of collective efficacy will uniquely contribute to team performance. As such, we expect that women's collective efficacy positively predicts team performance (Hypothesis 3a).

Furthermore, because we expect that women's team identification influences women's collective efficacy, and we also expect that women's collective efficacy has an impact on overall team performance, it follows that women's team identification impacts team performance indirectly through its effect on women's collective efficacy. Accordingly, we posit that women's team identification positively predicts team performance through its effect on women's collective efficacy (Hypothesis 3b).

Indirect Effect of Proportion of Women

Ultimately, via the linkages in the path, increasing the number of women on the team should influence solidarity and improve team performance via women's team identification and collective efficacy. Indeed, team identification has demonstrated a positive relationship with team performance (Bezrukova et al. 2009; Mesmer-Magnus et al. 2015; van Knippenberg 2000). Regarding the relationship between collective efficacy and team performance, solo status decreases task confidence and interest, but findings show that women peers protected one another's confidence in science teams (Dasgupta et al. 2015). In other words, women encourage one another to participate when they are together, allowing each other to make meaningful and important contributions to the team (Krishnan and Park 2005; Woolley et al. 2010).

It follows that if the proportion of women on the team influences women's collective efficacy through its impact on women's team identification, and women's team identification influences overall team performance through its impact on women's collective efficacy, then the proportion of women on the team also has an indirect effect on overall team performance through these two mechanisms. Thus, we hypothesize the proportion of women on the team positively predicts team performance through its effect on women's team identification and collective efficacy (Hypothesis 4).

Method

Sample and Task

We explored these ideas in a sample of 95 students enrolled in a social psychology course at a U.S. Southeastern technical institute. Students self-assembled into teams at the beginning of the semester and in all, there were 30 teams, each comprising 3–4 individuals. Although participants were included in this study as students taking a social psychology course, they came from many different majors, most of which were technical in nature. The distribution of majors for students in this class was: 33 in Computer Science (35%), 23 in Engineering (24%), 13 in Physical Science (e.g., Chemistry; 14%), 9 in Social Science (e.g., Psychology; 9%), 3 in Business (3%), and 14 in other majors (15%). Furthermore, our study was conducted at a traditional technical institution, where men dominate both the student body and faculty. During the academic year in which the study took place, men accounted for 74% of the student body and 77% of the faculty. In our study, 52 (55%) of the participants were male and 43 (45%) were women, and the resulting gender composition of the current sample of teams was: 9 all-men teams (0% women), 5 women minority teams (25%–33% women), 2 teams with equal men-women ratio (50% women), 10 women majority teams (66%–75% women), and 4 all-women teams (100% women). In compliance with standards for the ethical treatment of human participants, our study was approved by the institutional review board (Protocol #H11268).

Teams worked on an 8-week long project that required them to implement social psychological research findings for the innovative application of a real-world technology. Students were provided with one of five technologies on which to base their project, including RFID tagging, DNA recognition technology, telepresence robots, touchscreen tables, and speech-to-text technology. Each team was responsible for conducting a survey study to assess attitudes and behaviors surrounding the potential implementation of their selected technology. Teams chose a target population and collected responses from a small sample of the target group (approximately 30 respondents). At the end of the semester, each team produced an APA-style report with their findings, which served as the basis for the performance evaluation.

To aid their coordination throughout the semester, students were provided with various technologies. They were given access to technology such as WebEx™ video conferencing software and Basecamp™ project management software, as well as Google Groups to assist with email communication. Beyond these collaboration tools, teams had the opportunity to engage in additional communication technologies/tools, including Facebook, phone calls, and face-to-face meetings at their discretion. We provided the students with important milestones and deadlines throughout the project; however, teams otherwise operated as self-managing work teams (Hackman 1987)—free to set member roles, responsibilities, and the structure for how tasks would be accomplished.

Measures

Women's Team Identification

Team identification refers to the degree to which team members identify with the team (Eckel and Grossman 2005; Hinds and Mortensen 2005). Team identification was measured using Hinds and Mortensen's (2005) pictorial measure via an online survey administered in class during the second week of the project. At this point, students were required to make contact with their team members and outline their project as a group, and as such, they had sufficient time and contact with fellow team members to make judgments regarding identification with the team. Students were shown six boxes, each depicting two circles of varying levels of overlap. One circle represents the self, and the other represents the team. Participants were asked to select which set of circles best represents their relationship with their team, with 1 indicating no overlap and 6 indicating full overlap. The more overlap between the circles indicates greater identification with the team. To compute women's team identification, we averaged together only the women's responses to the measure. Thus women's team identification represents the degree to which women on the team feel as though they identify with the team.

To justify aggregation of individuals' scores to the team level of analysis, we report intraclass correlation coefficient (ICC) and r_{WG}. In both cases, the focus was the aggregation of women's ratings of the focal variables, and therefore each metric quantifies the similarity of women's perceptions on a given team. For ICC(1), which indicates the amount of variance in the focal variables due to group membership—in this case, the women on a given team—we used a cutoff of .10 [ICC(1); Bliese 1998; James 1982]. Furthermore, we also provide ICC(2), which represents the group mean reliability. For r_{WG}, which measures the extent to which women agree in their ratings of the focal variables (James et al. 1984), we determined cutoffs using the critical values reported by Smith-Crowe and colleagues (Smith-Crowe et al. 2014). These critical values indicate the statistical significance of a particular interrater agreement estimate. Smith-Crowe et al. (2014) report an extensive list of critical values for r_{WG} based on the number of items, response categories, and group size. However, their list is not exhaustive. Therefore, in determining cutoffs for r_{WG}, we chose a range of critical values that most closely fit the measures used in the current study.

Team identification is a single-item measure with six response categories. Smith-Crowe and colleagues (Smith-Crowe et al. 2014) suggest that for a group size of five (the lowest reported group size), the range of critical values for r_{WG} is between .81 (when using five response categories) and .86 (when using seven response categories). Aggregation metrics supported aggregation of women's individual ratings of team identification to the team level of analysis [median $r_{WG} = .83$, ICC(1) = .42, ICC(2) = .60]. Both r_{WG} and ICC values exceeded our indicated cutoffs, suggesting that the perceptions of women on each team are similar enough to be considered in the aggregate. Scores among women ranged from 1.00 to 5.67 ($M = 4.20$, $SD = 1.30$).

Women's Collective Efficacy

Collective efficacy reflects members' collective belief that their team will accomplish its tasks and goals (Bandura 1997; Lindsley et al. 1995; Zaccaro et al. 1995). Chen et al.'s (2001) five-item measure of generalized self-efficacy was used to measure collective efficacy via an online survey administered in class during the sixth week of the project. We measured collective efficacy in the sixth week of the project because this was the point at which participants were required to turn in a first draft for their assignment. Thus, they had to work together and produce a collective output, giving them adequate information to make a meaningful assessment of collective efficacy. Participants were asked to select their response on a 5-point scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). An adapted item from this scale reads, "When facing difficult tasks, I am certain that my team will accomplish them" (Chen et al. 2001). This measure showed adequate internal consistency ($\alpha = .95$). Similar to women's team identification, we computed women's collective efficacy by averaging the responses for women members on each team. Therefore, women's collective efficacy represents the shared belief among women in their team's ability to accomplish tasks and goals.

As was the case with identification, we use r_{WG} and ICC to justify aggregation of individual responses to the team level. For r_{WG}, Smith-Crowe et al. (2014) suggest that the critical value for a five-item measure with five response categories for a group size of five is .86. Thus, aggregation metrics supported aggregation of women's individual ratings of collective efficacy to the team level of analysis (median $r_{\mathrm{WG}} = .90$; ICC(1) = .62; ICC(2) = .77). Both r_{WG} and ICC values exceeded our indicated cutoffs, suggesting that the perceptions of women on each team are similar enough to be considered in the aggregate. Scores among women ranged from 2.40 to 5.00 ($M = 4.26$, $SD = .73$).

Team Performance

We gathered external measures of team performance via subject matter expert (SME) ratings in the eighth week of the project because teams' final reports were due at this time. SMEs consisted of PhDs and doctoral students in psychology who were unaware of the study's hypotheses. Two SMEs (from a group of six total SMEs) rated the write-up of the qualitative study for each team using behaviorally anchored rating scales (BARS) containing two dimensions. The first dimension was the quality of social psychology principles and applications. The overarching question for this dimension was, "Are relevant theories from social psychology described and appropriately applied to address the problem?" The second dimension was quality of research methods. The overarching question for this dimension was, "Are appropriate research methods utilized and interpreted in terms of data collection and analysis?" The SME ratings were averaged for each team resulting in one performance score per SME pair. To assess interrater reliability, we computed r_{WG} for each pair of raters. Smith-Crowe et al. (2014) only provide critical values for groups as small as 5, and so we were unable to determine an appropriate cutoff value for r_{WG} in this case. However, there was very strong agreement among rater pairs in their evaluations of performance (median $r_{\mathrm{WG}} = .96$) and as such, we proceeded to average individual responses into a single performance score for each team.

Covariates

We wanted to rule out prior familiarity with teammates as an alternative explanation for observed relationships between the proportion of women on the team, women's team identification, women's collective efficacy, and overall team performance. Team familiarity was measured using a survey administered prior to team formation. Respondents viewed a roster with the names of all classmates and indicated whether or not they knew the person on the list by checking off his/her name. This round robin method (Kenny and La Voie 1984) captures each participant's familiarity with every other member in the class. Prior familiarity was coded as 1, and no familiarity was coded as 0. The familiarity network for the class was then partitioned to create a network for each team and assess who on the team had a prior relationship. Next, we computed a density score by taking the ratio of existing familiarity ties and the total possible number of familiarity ties (Wasserman and Faust 1994). For example, there are six total possible ties in a team of three people. Therefore, the density of familiarity ties in this team is (3/6) = .50, meaning that half of the members on the team are familiar with one another. In the current sample, prior familiarity density ranged from 0 (no familiarity among any team members) to 1 (full familiarity among all team members), and the average level of prior familiarity density was .29 ($SD = .30$).

Analytic Approach

In order to test the hypothesized relationships in our conceptual model (Hypotheses 1–4), we performed a path analysis with maximum likelihood estimation using the R package "lavaan" (Rosseel 2012). The convention to assess model fit is a non-significant Chi-square, and fit criteria within specified ranges. Hu and Bentler's (1999) fit criteria guidelines suggest that a good model fit is greater than or equal to .95 comparative fit index (CFI), less than or equal to .08 for root mean squared error of approximation (RMSEA), and less than or equal to .06 for standardized root mean squared residual (SRMR).

To test for the mediation effects (i.e., women's team identification and women's collective efficacy), we used James et al.'s (2006) mediation approach. This approach suggests that mediation is confirmed if "(a) the model has an acceptable fit; (b) the relationship between the predictor and mediator is significant; [and] (c) the relationship between the mediator and outcome is significant" (Murase et al. 2014, p. 9). To test for the indirect effects specified in Hypotheses 2b, 3b, and 4, we used a bootstrapping procedure in the lavaan package (Rosseel 2012). This procedure calculates bias-corrected confidence intervals (CIs) to examine statistical significance of the indirect effects; if the CIs do not contain zero, this suggests that the indirect effects are statistically significant.

Because men, as a general category, are not minorities in scientific and technical enterprises (Beede et al. 2011; Catalyst 2017; Shih 2006), we did not expect their experience of working in the team to be influenced by the teams' gender composition. Nonetheless, in order to consider the possibility that gender composition affects both genders' experience of teamwork, we also applied our analytic approach on a model looking at the same variables from the men's perspective (i.e., a second subset of the sample; $n = 26$). For this analysis we used the same procedures previously discussed for women to compute men's team identification and men's collective efficacy. We tested all the same hypothesized links between variables as in the women's model.

Results

Correlations among the study variables are shown in Table 1. Descriptive information for each variable, broken down by percentage of women or percentage of men is found in Table 2. For reference, Table 1 includes correlations between women's and men's perceptions. As shown in Table 1, men's perceptions were only moderately or weakly correlated with that of women's (team identification: $r = .10$, $p = .715$; collective efficacy: $r = .17$, $p = .534$). Additionally, correlations between men's identification or collective efficacy with team performance was moderate but not significant (male identification: $r = -.04$, $p = .857$; male collective efficacy: $r = .22$, $p = .288$). This supports the idea that men and women have different teamwork experiences, depending on the team's gender composition.

Our focal hypotheses were tested with path analysis. First we investigated the overall fit of the data to our hypothesized model, and the results of the path model indicated good model fit, $\chi^2(3, n = 21) = 2.74$, $p = .434$ (CFI = 1.00, RMSEA = .00, SRMR = .05). Next, we tested each hypothesis by examining the path coefficient and associated p value for each focal relationship. Figure 1a presents the supported paths and associated coefficients for the hypothesized model.

Hypothesis 1 posited that the proportion of women on a team would positively predict women's team identification. Results indicate that the number of women on the team significantly and positively predicted women's team identification ($B = 3.13$, $p = .019$). Nearly 30% of the variance in women's identification was accounted for by the gender composition of the team ($R^2 = .29$). Additionally, prior familiarity was unrelated to team identification ($B = -.38$, $p = .752$). As such, Hypothesis 1 was supported.

Hypothesis 2a proposed that women's team identification would positively predict their collective efficacy. Hypothesis 2a was supported: The path coefficient indicates team identification significantly and positively predicted collective efficacy ($B = .40$, $p < .001$, $R^2 = .52$). Thus, having more women on the team was associated with women's belief in the capability of the team to perform. Hypothesis 2b posited a mediated effect, whereby the proportion of women on the team would positively predict women's collective efficacy through its effect on women's team identification. To test the indirect effect, we used bootstrapping analyses. Results show the bias-corrected 95% CI around the indirect effect of the number of women on the team on collective efficacy via team

Table 1 Descriptive statistics and correlations among study variables

Variable	M	SD	Correlations 1	2	3	4	5	6	7
1. Prior familiarity	.28	.28	–						
2. Percentage of women	.64	.23	.21	–					
3. Women's team identification	4.20	1.30	.04	.53*	–				
4. Women's collective efficacy	4.26	.73	.11	.51*	.71**	–			
5. Team performance	2.88	.60	.13	.34	.30	.64**	–		
6. Percentage of men	4.58	.83	.02	-1***	−.53*	−.51*	−.09	–	
7. Men's team identification	4.19	.52	.46*	−.07	.10	.25	−.04	.07	–
8. Men's collective efficacy	2.88	.48	−.24	−.34	−.38	.17	.22	.34	.21

$n = 21$ teams with women and $n = 26$ teams with men. ICC = intraclass correlation coefficient, where ICC(1) is the amount of variance in focal variables due to group membership and ICC(2) is group mean reliability. r_{WG} is the extent to which women and men, respectively, agree in their ratings of focal variables. For Women's Team Identification r_{WG} median = .83, ICC(1) = .42, ICC(2) = .60. For Women's Collective Efficacy, Cronbach alpha = .95, r_{WG} median = .90, ICC(1) = .62, ICC(2) = .77. For Team Performance, r_{WG} median = .96. For Men's Team Identification r_{WG} median = .83, ICC(1) = .13, ICC(2) = .22. For Men's Collective Efficacy, Cronbach alpha = .95, r_{WG} median = .91, ICC(1) = .21, ICC(2) = .33

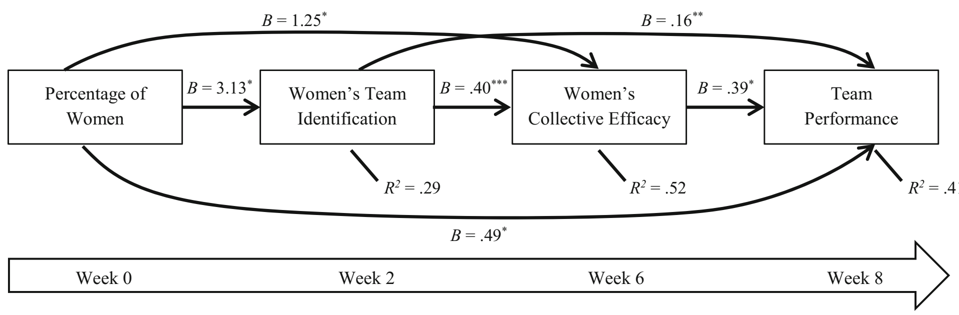
*$p < .05$. **$p < .01$. ***$p < .001$

Table 2 Descriptive statistics for focal variables by percent of women and percent of men

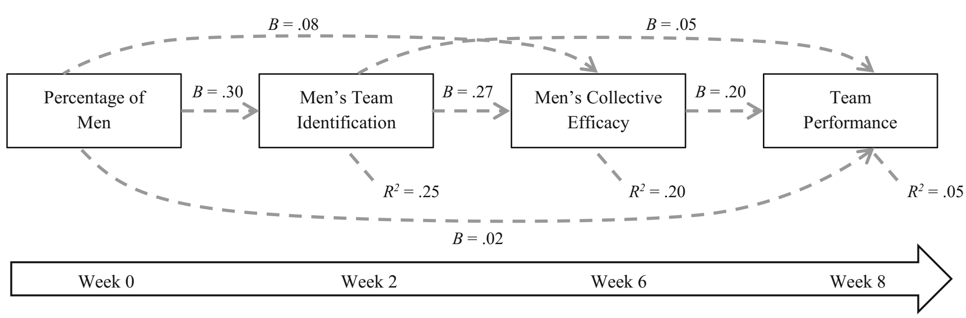
Variable	Percentage of Women = .33		Percentage of Women = .50		Percentage of Women = .66–.75		Percentage of Women = 1.00	
Subset 1	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Prior familiarity	.13	.30	.42	.12	.30	.33	.33	.14
Women's team identification	3.20	1.92	3.75	1.06	4.37	.90	5.25	.32
Women's collective efficacy	3.72	.98	3.55	.49	4.50	.54	4.67	.30
Team performance	2.68	.28	2.20	.57	3.07	.37	2.98	.50
n	5		2		10		4	
	Percentage of Men = .25–.33		Percentage of Men = .50		Percentage of Men = .67		Percentage of Men = 1.00	
Subset 2	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Prior familiarity	.30	.33	.42	.12	.13	.30	.33	.34
Men's team identification	4.60	.97	4.00	.71	4.60	.65	4.67	.87
Men's collective efficacy	4.07	.55	3.55	1.06	4.28	.43	4.42	.32
Team performance	3.07	.37	2.20	.57	2.68	.28	2.92	.54
n	10		2		5		9	

identification excludes zero ($B_{indirect} = 1.25$, $p = .045$, bias-corrected 95% CI [.07, 2.50]). Additionally, prior familiarity was unrelated to collective efficacy ($B = .22$, $p = .639$). Taken together with good model fit and a positive relationship between women's team identification and collective efficacy (Hypothesis 2a), Hypothesis 2b was supported.

Hypothesis 3a predicted that women's collective efficacy would positively predict overall team performance. Results



a) Model of women's experience in work teams



b) Model of men's experience in work teams

Fig. 1 The results for the hypothesized path model, showing the effect of percentage of a given gender on the team on team performance through its effect on the respective gender's team identification and collective efficacy. Figure **a** displays the results for teams with at least one woman on the team [Fit criteria: χ^2 (3, $n = 21$) = 2.74, $p = .434$; CFI = 1.00, RMSEA = .00, SRMR = .05], Figure **b** displays the results for teams with at least one man on the team [Fit criteria: χ^2 (3, $n = 26$) = 3.63, $p = .304$; CFI = .93, RMSEA = .09, SRMR = .08.]. Both models controlled for prior familiarity, which was unrelated to the focal variables in Figure **a** and had mixed effects in Figure **b** (men's team identification: $B = 1.33$, $p = .022$; men's collective efficacy: $B = -.75$, $p = .162$; team performance: $B = -.04$, $p = .909$). In both Figures **a** and **b**, B = unstandardized coefficient, solid black lines indicate significant paths, and dashed grey lines indicate non-significant paths. Analyses were conducted at the team level. *$p < .05$, **$p < .01$, ***$p < .001$

indicate that collective efficacy significantly and positively predicted team performance ($B = .39$, $p = .017$, $R^2 = .41$); thus, Hypothesis 3a was supported. Hypothesis 3b posited that women's team identification would positively predict overall team performance through its effect on women's collective efficacy. The results of the bootstrapping analyses show that the bias-corrected 95% CI around the indirect effect of women's team identification on team performance via women's collective efficacy excludes zero ($B_{\text{indirect}} = .16$, $p = .005$, bias-corrected 95% CI [.06, .28]). Additionally, prior familiarity was unrelated to team performance ($B = .09$, $p = .771$). Taken together with good model fit and support for Hypotheses 2a and 3a, these results supported Hypothesis 3b.

Finally, Hypothesis 4 hypothesized that the proportion of women on a team would positively predict team performance through its effect on women's team identification and collective efficacy. The results of the bootstrapping analyses show that the bias-corrected 95% CI around the indirect effect of percentage of women members on team performance via women's team identification and collective efficacy excludes zero ($B_{\text{indirect}} = .49$, $p = .034$, bias-corrected 95% CI [.07, 1.07]). Taken together with good model fit and support for Hypotheses 1, 2a and 3a, results indicated support for Hypothesis 4.

Finally, for completeness, we also conducted supplemental analyses, testing all the focal relationships from the men's perspective. Here, aggregation of team identification and collective efficacy account for only men's ratings in each team. The results of the path analysis are presented Fig. 1b. As shown in Fig. 1b, the model does not fit the data well: χ^2 (3, $n = 26$) = 3.63, $p = .304$ (CFI = .93, RMSEA = .09, SRMR = .08). Moreover, none of the relationships among focal variables was significant. Overall, this pattern provides further support for the idea that gender composition affects how women, but not men, experience working in teams.

Discussion

We explored the effect of women's representation in teams as a contextual factor impacting two emergent properties of effective teams: team identification and collective efficacy. The current findings suggest women's representation matters for their experience in teamwork: The proportion of women on a team positively influences their team identification and collective efficacy, which improves team performance.

Our analysis revealed that the percentage of women was critical in the development of those women's team identification. Accounting for participants' familiarity with their teammates prior to the project, the percentage of women on the team predicted 29% of the variance in women's team identification. This outcome supports the idea that women need representation on a team in order to feel a connection to or fit with the group. Interestingly, this finding also suggests that the mere presence of women on the team was enough to trigger this process. Yet we did not find the same effect for men. The representation of men on the team was not positively related to men's team identification. Taken together, these outcomes lend support to previous work on racial/ethnic minority identity, which found that the presence of minority members increased identification (Oakes 1987; Tajfel and Turner 1986; van Knippenberg 2000).

We also found that the percentage of women was critical for women's collective efficacy beliefs as mediated through women's team identification. The representation of women was related to their sense of identification and a positive indicator of the team's chances to be effective. Our model predicted 52% of the variance in women's collective efficacy. Additionally, as expected, this mediation was not observed for men, meaning men's sense of collective efficacy was not tied to their representation on the team. On the matters of team identity and efficacy, we argue women in STEM settings often confront harsher judgments of their competence compared to men. The perception is that women do not perform well in STEM-related work, and this can cause a stereotype threat; however, that threat is diminished when more women are present on the team (Steele 1997).

A final major finding is that the percentage of women on the team is indirectly related to team performance through its relation to team identification and collective efficacy. Together the focal variables and prior familiarity accounted for 41% of the variance in team performance. The relationship between collective efficacy and team performance has been well established in the literature (Stajkovic et al. 2009). The interesting finding in our study is that women's collective efficacy—boosted through the number of women on the team and stronger identification, in particular—was related to team performance, but the collective efficacy perceptions among men on the team was not significantly related. Therefore, these findings suggest that not only does the representation of women on the team alter women's team experience, but it also serves the entire team through enhanced performance.

Limitations

Although our study lends new insight to how women experience teamwork, there are several important limitations to consider. First, although we chose participants from a technical institute because they reflected the broader population in which we are interested, with respect to both expertise and gender distribution, the teams in our sample were students, not professionals working in the context of a science or technical corporation. In terms of generalizability, our sample is more representative of entry-level scientific and technical workers and not necessarily of top management team members. It is also important to note that the setting is one with a long history of having a male majority that has been actively working to correct the gender imbalance through admissions and campus initiatives. Future research is needed to examine these effects within teams in organizations that are less active in promoting gender balance or, alternatively, organizations that are further along in realizing a gender balance.

Second, the participants in our study worked together for only 8 weeks, after which they were dissolved. Thus, there may be some important differences in the current sample and the populations found in professional settings. For example, the work students produced did not impact future projects. If they performed poorly on this project, they would not be judged by their peers and potentially lose out on future project opportunities due to the quality of their work. Moreover, our participants did not face the prospect of a decrease in pay or loss of their job as a result of their performance on this project. Team dynamics in this study may not have accurately reflected the stakes under which professionals operate as a result. Even so, it is important to note that many of the computer science and engineering courses at our study's institution are team-based, and so reputational effects could limit students' opportunities to work with high-quality teammates in future semesters.

Third, in the current study, we mimicked autonomous real-world teams by allowing participants to self-select their teammates. However, this self-selection presents a potential confound in that it may have played a role in contributing to an individual's sense of identification and collective efficacy. For example, it could be that women who chose to work with other women were more motivated, proactive, and gender-informed than were those who waited to be chosen by others. The ability to "control their destiny" in choosing their fellow team members may have been a factor that is not accounted for in the current study.

Future Research Directions

Our research opens up several interesting lines of inquiry for future research. First, to what extent are our findings due to gender differences only? We rely on women's minority status (Piazza and Castellucci 2014) as a way to understand these relations, and in fact, we study this phenomenon in a predominantly male environment. However, we ignore issues of intersectionality (Crenshaw 1989). Future research may address how these relationships play out in the case in which a woman's identity also intersects with minority status on another visible characteristic, such as race/ethnicity. Additionally, future research may continue this line of work through different experimental designs. For example, to resolve one limitation of the current study, future research designs should randomly assign people to teams in order to tease apart the effects of self-selection and team functioning and effectiveness.

Another interesting avenue for future research is to explore the interplay of gender and status within teams. It may be the case that status differentials are confounded with gender differences in our current context (Greer and Bendersky 2013; Metcalfe and Linstead 2003). In our study of science teams, women may have had lower status than men, and so status could provide an alternative mechanism explaining the differential susceptibility of each gender to team gender composition. Future research is needed to directly measure status perceptions within the team and to explore additional contexts where women are high status members.

A final interesting avenue for future research is to explore the effects of individual differences on how women experience teamwork. It may be the case that highly agentic or narcissistic women are less sensitive to the gender composition of the team. Conversely, it may also be the case that more affiliative and psychologically collective women are even more sensitive to gender composition. There may also be individual differences in the extent to which women feel that their gender is central to their own identity. Perhaps women with certain dispositions may be more or less likely to respond to the representation of other women. It is important to understand how different women may differentially experience the team context.

Practice Implications

In practice, there is a tendency to diversify teams by appointing a token member of an underrepresented group. However, these findings suggest it is important to enable gender minority members to work on teams with other members of their minority. Doing so improves their psychological attachment to and confidence in the team. Given a choice between staffing teams with one minority member each or creating a smaller set of teams with a representative group, there are clear advantages to the latter. Ensuring minority members have representation in the team benefits their team identification and collective efficacy. Therefore, the primary reason why representation of women in STEM teams is important is a moral one. If managers and leaders can improve upon the experiences of women in teams through careful composition of those teams, they should take the opportunity to do so.

Additionally, there is a "business case" for the representation of women in these types of teams because our findings also suggest that a larger proportion of women on the team is related to the team's better performance. Although scientific and technical enterprises are making advances with teams as they stand today (predominantly male), we argue that the inclusion of several women on the team may further encourage effective team performance. As a result, we may see even greater advancements in these important fields.

Conclusion

Teams are the cornerstone of grand innovations (Jones 2009; Wuchty et al. 2007), and despite women's natural proclivity for collaboration (Eagly and Johnson 1990; Eagly and Karau 1991; Woolley et al. 2010), women continue to be underrepresented in corporations, particularly those that are scientifically and technically focused (Beede et al. 2011; Catalyst 2017; Dasgupta et al. 2015; Wright et al. 2015). Because of their minority status, women may experience teamwork differently than men as a function of the gender composition of the team. We have built on existing literature to demonstrate how the proportion of women on a team serves to influence their collective perceptions of the team and the team's ultimate performance. Managers and leaders should focus on this issue because the representation of women matters for women's team identification and collective efficacy. Additionally, our findings ultimately suggest that in STEM work, the lack of representation of women in these teams is a missed opportunity for the performance of these enterprises. Our study identifies that in a STEM context, it is not a matter of women's abilities, but more a matter of their representation on the team. Further exploration of the effects of demographic diversity on team process is encouraged.

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