



A field examination of the moderating role of group trust in group efficacy formation

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Although support for the positive effect of group efficacy on group performance is copious, our understanding of how group efficacy forms is scant. Much remains unanswered about how the four efficacy antecedents, defined by social cognitive theory as enacted mastery, vicarious learning, social persuasion, and affect, concurrently influence group efficacy. Complementing the homology assumption of social cognitive theory, the authors propose and test a differential moderation model of group trust, in which group trust interacts synergistically or compensatorily with the four antecedents of group efficacy depending on the information content they provide. The results, based on 100 work groups in a manufacturing plant in China, showed that past group performance and group social persuasion were positively related to group efficacy, but that group vicarious learning and group positive affect were not. A significant interaction with group trust was found for group vicarious learning and for group positive affect. Finally, group efficacy was positively related to subsequent group performance, even after controlling for the four efficacy antecedents and group trust. Theoretical and practical implications are discussed.

Practitioner points

- Group efficacy is a significant predictor of group performance.
- Building trust in work groups is a credible and critical managerial action for group efficacy formation.

Contemporary organizations increasingly use work groups (Gibson, 1999; Petitta & Borgogni, 2011; Zhang & Peterson, 2011). Work groups, when functional, provide members with an ongoing source of motivation, job training, and social support. A strong predictor of group success is group efficacy, defined as the group members' shared belief in their capabilities to perform together (Bandura, 1982; Collins & Parker, 2010; Stajkovic, Lee, & Nyberg, 2009; Zaccaro, Blair, Peterson, & Zazanis, 1995). Although group members' skills, motivation, and other resources (e.g., financial) are necessary for performance, a unit of skilled and motivated individuals can turn into a poorly performing group when group members doubt their ability to work together and coordinate action as one unit (Bandura, 2000; Magyar, Feltz, & Simpson, 2004). Indeed, research in various settings supports group efficacy as a predictor of group performance (e.g., Gibson, 1999; Jung & Sosik, 2003; Myers, Feltz, & Short, 2004).

However, compared to the volume of research support for the positive effect of group efficacy on group performance, relatively little is known about how group efficacy forms.

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Social cognitive theory (Bandura, 1982, 1986, 1997) made a cross-level homologous assumption generalizing the four self-efficacy antecedents at the individual level to group efficacy at the group level. Accordingly, enacted mastery (i.e., past performance), vicarious learning, social persuasion, and affect have been posited as the four antecedents of group efficacy.

We build upon this conceptualization and further contend that such a homologous assumption limits our understanding of group efficacy formation for two reasons. First, group attainment is not limited to the sum of individuals' contributions, but is the product of their coordinative, cooperative, and synergetic dynamics (Thompson, 2013). Second, the interactive nature of group dynamics makes group efficacy an emergent group attribute, which is distinct from the simple sum of individuals' self-efficacies (Gibson & Earley, 2007).

To address this gap in the literature, we propose that the four efficacy antecedents may not function as monotonically for group efficacy as they do for self-efficacy and that group trust moderates group efficacy formation. Group trust is defined as a group's shared psychological state characterized by a willingness to be vulnerable to others in the group based on positive expectations about their intentions and behaviours (de Jong & Elfring, 2010; Gibson & Manuel, 2003). Although it has been suggested that trust contributes to group functioning (Dirks, 1999; Mach, Dolan, & Tzafirir, 2010; Simons & Peterson, 2000), its role in group efficacy formation has not been examined.

Specifically, we examine the moderating role of group trust in the process of group efficacy formation. We hypothesize that group trust moderates the effects of the four efficacy antecedents differentially, either synergistically or compensatorily, depending on the information conveyed by the antecedents. Scant prior research has investigated the four antecedents, and, to our best knowledge, no study has yet examined the concurrent influences of all four antecedents on group efficacy. Examining their concurrent functioning, as conceptually posited by social cognitive theory, along with their interaction with group trust as we propose, contributes to our understanding of group efficacy formation. Simply put, although we know that the black box works, we are trying to see what is in it.

We proceed as follows. First, we review the theoretical foundation of the four group efficacy antecedents. Second, we build upon this foundation by developing hypotheses with differential predictions for the way group trust moderates the relationship between each of the antecedents and group efficacy. Finally, using field data from 100 work groups operating in a manufacturing plant in China, we test the hypothesized moderating role of group trust, as well as the predictive validity of group efficacy in relation to group performance. Figure 1 provides an overview of the relationships examined in this study.

Theoretical background

Social cognitive theory antecedents of group efficacy

Group efficacy is formed as group members cognitively process, interpret, and evaluate each of the four efficacy antecedents (Bandura, 2000). The first of the four antecedents is past group performance. Past group performance represents a group's enacted mastery experiences by capturing the extent to which the group accomplished its goals (Hackman, 1990). It is considered the most influential antecedent of group efficacy because it is the only one that provides direct information about group performance (Bandura, 1997). When assessing whether the group is efficacious enough to successfully

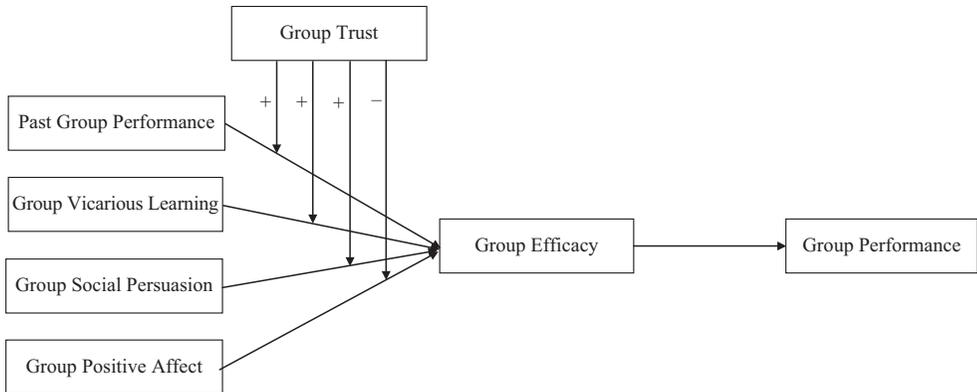


Figure 1. Conceptual model. + indicates synergistic interaction; – indicates compensatory interaction.

perform a given task, group members base their assessment, in part, on their past enacted experiences, because past performance indicates which skills the group has and which skills are needed to improve performance (Bandura, 1997).

The second antecedent of group efficacy is group vicarious learning, defined as a group's collective experience of knowledge acquisition regarding a specific task through observation of behaviours enacted by referent models. Vicarious learning provides opportunities to learn new skills more effectively and efficiently (Prussia & Kinicki, 1996; Taylor, Russ-Eft, & Chan, 2005). For example, when a group needs to perform a new task or substantially improve its current performance, it can observe, compare, evaluate, and adopt the behaviours of other successful groups (Bandura, 1986). In this way, group vicarious learning enables the group to assess its functioning in comparison with other groups, to gain new understanding about its own task performance, and to avoid costly trial-and-error mistakes (Schnake, 1986).

The third antecedent is group social persuasion, defined as a group's collective experience of receiving verbal encouragement in support of accomplishing a specific task (Brown, 2003). Verbal support can come from both inside and outside of the group. Groups with intragroup encouragement have stronger group efficacy beliefs and perform more effectively compared with groups that lack such support (Brown, 2003; Hackman, 1990). Verbal encouragement from outsiders also affects group efficacy, as groups acquire certain reputations. Research indicates that groups labelled as 'effective' are more likely to receive favourable assignments and support (Hackman, 1990), reinforcing the view of both outsiders and group members that the group is effective. Likewise, a group labelled 'ineffective' can fall victim to a self-fulfilling prophecy, leading to a downward spiral of group efficacy (Lindsley, Brass, & Thomas, 1995).

The fourth group efficacy antecedent is group affect, defined as an affective tone shared by group members that represents the overall mood of the group as a whole (Barsade & Knight, 2015; George, 1990; Knight & Eisenkraft, 2015). Research shows that group members can converge on a common affective state (George, 1990), which provides a lens through which events are interpreted, cognitively organized, and stored in and retrieved from memory (Forgas, 1995; Seo, Barrett, & Bartunex, 2004). Groups with higher levels of positive affect are more likely to search for information tagged to positive cues from experiences, resulting in higher group efficacy, compared with groups with lower levels of positive affect (Gibson, 2003; Gibson & Earley, 2007; Walter & Bruch, 2008).

Hypothesis 1a: Past group performance is positively related to group efficacy.

Hypothesis 2a: Group vicarious learning is positively related to group efficacy.

Hypothesis 3a: Group social persuasion is positively related to group efficacy.

Hypothesis 4a: Group positive affect is positively related to group efficacy.

The moderating role of group trust

Bandura (1997) called for research towards the ‘advancement of knowledge about the determinants, mechanisms, and outcomes of collective efficacy’ (p. 478). Yet, research on how the four efficacy antecedents influence group efficacy is scant with mixed results. For example, several studies on the relationship between past group performance and group efficacy have reported results ranging from a significant positive relationship (e.g., Jung & Sosik, 2003; Prussia & Kinicki, 1996) to a non-significant relationship (e.g., Chen *et al.*, 2002) to a significant but negative relationship (e.g., Myers *et al.*, 2004). One study examined group vicarious learning and found it predictive of students’ group efficacy on a brainstorming task (Prussia & Kinicki, 1996). Another study examined group social persuasion in the form of group-level verbal self-guidance and found that it was related to group efficacy (Brown, 2003). Gibson (2003) examined group positive affect in both a laboratory and a field setting and found a significant effect on group efficacy in the laboratory, but the effect diminished in magnitude in the field to two-tailed non-significance (or one-tailed significance, as was reported).

To enhance our limited understanding of group efficacy formation, we propose a differential moderation model of group trust, in which increasing group trust can strengthen or weaken the relationships between the antecedents and group efficacy depending on the information conveyed by the antecedents. Work groups face increasingly difficult problems to solve as interdependence and uncertainty increase in organizations (Hackman, 2012). To effectively function, groups must cope with the growing complexity of workplace requirements by gaining new perspectives to analyse problems and find solutions. Consequently, group trust is essential for successful group functioning (de Jong, Dirks, & Gillespie, 2016). Trust at the group level is the ‘shared generalized perceptions of trust’ (de Jong & Elfring, 2010, p. 536) that group members have in their fellow members, and is expected to affect outcomes in similar ways as interpersonal trust (Mayer, Davis, & Schoorman, 1995). Although the perception of trust resides within the individuals, it is the shared perspective among group members that makes trust a group-level variable. Emerging from social categorization processes (Williams, 2001), sense-making of shared experiences (Shamir & Lapidot, 2003), and social structures that govern interpersonal interactions (McKnight, Cummings, & Chervany, 1998), group trust facilitates effective communication, coordination, and cooperation among group members. Without group trust, a group can easily become dysfunctional, as mistrusting members tend to focus on watching their backs rather than on improving performance (Kramer, 1999).

Trust among individuals develops on the basis of cognitive and/or affective foundations (Lewis & Weigert, 1985; McAllister, 1995; Williams, 2001). Cognitive foundations concern ‘objective’ reasons to trust others, such as knowledge about their competence and responsibility. Affective foundations consist of emotional and relational

bonds, such as care and concern for each other and beliefs in the intrinsic virtue of the relationship.

In this study, we focus on affect-based group trust for two reasons. First, affect-based trust, also called relational trust (Rousseau, Sitkin, Burt, & Camerer, 1998), develops through repeated interpersonal interactions. In work groups, relationships and emotional bonds form among members, allowing a shared identity to emerge and interpersonal ties to strengthen (Gaertner, Dovidio, & Bachman, 1996). With strengthened interpersonal ties, affect-based trust becomes more resilient to violations than cognition-based trust because it is founded on reciprocal care arising through long-term relationships (McAllister, 1995; Rousseau *et al.*, 1998). As ongoing interactions involve a broad range of resource exchanges, faith in the intention of others becomes more significant, and the history of successful expectation fulfilment reinforces the willingness of group members to trust and depend on one another (Lewis & Weigert, 1985).

Second, affect-based group trust appears to be more relevant across cultures (Chua, Morris, & Ingram, 2009; Tan & Chee, 2005). In a study with Chinese entrepreneurs, Tan and Chee (2005) found that trust is mostly determined by affective factors such as mutual understanding and help, rather than by cognitive factors such as professionalism and competence. The reason provided was that 'trust relationship in the work context is characterized by a greater investment of time and emotion relative to cognitive conditions and that it begins with personal relationships or friendship' (Tan & Chee, 2005, p. 205). Also, Chua *et al.* (2009) found that cognition- and affect-based trust are more highly intertwined among Chinese managers than among American managers and that the former are more likely to derive affect-based trust from work relationships. Taken together, we expect affect-based trust to be prominent among work groups in China, the site of this study, and hereafter refer to affect-based group trust as group trust.

Similarly to trust, the information conveyed by the four efficacy antecedents can be categorized as cognitive or affective. Social cognitive theory states that the information from the group's enacted experiences, vicarious learning, and social persuasion is primarily cognitive (Bandura, 1997). This is because the information conveyed by these three antecedents tends to be diagnostic of the group's capacity to perform successfully, ability to perform new tasks, similarity with the model group, and the reasonableness of verbal persuasion received. Conversely, the information provided by group affect is, by definition, affective. Thus, we propose a differential interaction of group trust with the four group efficacy antecedents depending on whether the information conveyed by the antecedents is cognitive or affective.

Synergistic interaction. Group trust will synergistically interact with past group performance, group vicarious learning, and group social persuasion, which provide cognitive information in group efficacy formation, as group trust affects how such diagnostic information is interpreted and evaluated. Drawing from Dirks and Ferrin (2001), we posit that group trust influences both the interpretation of past actions of the group and the assessment of future group actions. The latter process is based on the former, and the interpretation of past actions invites individuals to make causal attributions (Tomlinson & Mayer, 2009; Weiner, 1986). In particular, information about past success or failure is not directly translated to group efficacy because it is not performance *per se* that changes the level of efficacy but what is cognitively extracted from the past experiences (Bandura, 1997; Riggs & Knight, 1994). Accordingly, groups with different levels of group trust, but with the same level of past performance, can

perceive their past performance differently. High group trust facilitates attribution of positive diagnostic information to internal, controllable, and stable factors (Tomlinson & Mayer, 2009), and such self-enhancing attributions boost the expected positive relationship between past group performance and group efficacy. Conversely, low group trust promotes attribution of an equally positive performance to external, uncontrollable, and unsustainable factors, making the performance less likely to contribute to group efficacy. Moreover, members of a group with low trust tend to divert their time and energy to self-protection, which can lead to social loafing.

Hypothesis 1b: The relationship between past group performance and group efficacy becomes stronger as group trust increases.

Group trust also moderates how information observed through group vicarious learning is cognitively processed. It does so by enabling open communication among group members (Lumsden & Lumsden, 2009) and facilitating constructive discussion on the transfer and implementation of new information observed from others. Groups with high levels of trust are more willing to take risks (Dirks, 1999; Mayer *et al.*, 1995; McAllister, 1995), creating a setting in which information from group vicarious learning is objectively observed, critically assessed for utility, and applied (Kramer, 1999). In contrast, if group members do not trust one another, defensive communication is more likely to occur (Lumsden & Lumsden, 2009). Thus, group trust helps groups identify with successful model groups from which they can learn and conclude that they, too, can develop the internal, controllable, and sustainable skills observed in the model groups (Tomlinson & Mayer, 2009).

Hypothesis 2b: The relationship between group vicarious learning and group efficacy becomes stronger as group trust increases.

Group social persuasion also provides diagnostic information about the group's capabilities, and group trust influences its interpretation through causal attributions. For example, when a manager communicates to a group that it is competent, group efficacy can increase if group trust is high. This is because the positive message is more likely to be attributed to internal, controllable, and stable characteristics of the group (Tomlinson & Mayer, 2009). Conversely, if group trust is low, members are less likely to accept and internalize the encouragement. The role of such information is thus diminished in group efficacy formation, as group members know that they will not exert their best efforts and that individual contributions will not be coordinated effectively and efficiently due to the lack of trust (Peterson & Behfar, 2003).

Hypothesis 3b: The relationship between group social persuasion and group efficacy becomes stronger as group trust increases.

Compensatory interaction. Groups differ in their proneness to group affect (George, 1990), and group trust can increase or decrease the salience of group affect (Tsai, Chi, Grandey, & Fung, 2012), and thus its effect on group efficacy. Groups with low trust are more susceptible to the influence of group affect on group efficacy because they tend to exhibit low group efficacy, which leaves greater improvement potential. Additionally, members of low trusting groups tend to become vigilant self-monitors (Kramer, 1999). As self-monitoring increases, the members become more attentive to subjective aspects of

the group, such as group affect. As a result, the affective tone of the group is noticed, increasing the likelihood of mood-congruent recall and judgment in efficacy formation. Thus, we propose that group trust moderates the relationship between group positive affect and group efficacy in a compensatory rather than synergistic way.

The influence of group affect on group efficacy occurs in the context of the other, more diagnostic, efficacy antecedents. Past group performance, group vicarious learning, and group social persuasion are likely to be given greater weight in efficacy appraisal by trusting members, because they are more objective and reliable indicators of the group's capabilities (Bandura, 1997). Moreover, given that group trust develops on the basis of emotional bonds among group members over time (McAllister, 1995; Williams, 2001), group positive affect may provide redundant information in the context of high group trust. As such, the relationship between group positive affect and group efficacy is expected to vary as a function of group trust.

Hypothesis 4b: The relationship between group positive affect and group efficacy becomes weaker as group trust increases.

Group efficacy and group performance

The relationship between group efficacy and group performance is described in detail elsewhere (Bandura, 1997, 2000), and their empirical association has been documented in past research (Gully, Incalcaterra, Joshi, & Beaubien, 2002; Stajkovic *et al.*, 2009). Briefly, 'a group's capability to perform as a whole can vary widely under different blends of interactive dynamics' (Bandura, 1997, p. 478), and the increasingly group-oriented nature of work in organizations underscores the importance of group efficacy to accomplish desired outcomes. To add to the external validity, we examine this relationship in an organizational setting in China.

Hypothesis 5: Group efficacy is positively related to group performance.

Method

Study site

The study took place in a manufacturing plant in China. All employees in this plant were organized in work groups across seven divisions that manufactured various non-ferrous metal products. The seven divisions included three copper product divisions, an aluminium and magnesium division, a smelting division, a melting and casting division, and a metallurgical division. By design, the jobs performed could not be handled by any single individual. Thus, interdependence in groups was high, and no measures of individual performance existed.

Sample and procedures

We conducted several on-site meetings with the managers of this plant before data collection. Details were agreed upon by the plant's top 16 managers, including the CEO. Performance data were obtained from the company records, independently of the survey data collection. Survey questionnaires, developed through a systematic back-translation procedure (Brislin, 1980), were completed during regular work hours, on different days to

reduce common method bias. The questionnaire items used a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree), unless stated otherwise. The actual sizes of work groups ranged from 3 to 17 members, but plant managers randomly selected half (for groups with an even number of members) or slightly over half (for groups with an odd number of members) of the total number of members in each group to participate in our study.¹ This was carried out to ensure adequate representation of each group while allowing the plant to continue normal operations.

The respondents were administered the measures of group vicarious learning, group social persuasion, group positive affect, and group trust on the first day, and the measure of group efficacy 3 days later. Four groups were excluded due to unusable responses. The final sample consisted of 100 groups, with a total of 480 respondents. The average age of the respondents was 31, and 20% were female. About 70% reported having a high school diploma, and 6% reported having a bachelor's degree. Their average tenure with the organization was 10.74 years.

Measures

Group performance

Although groups manufactured different products depending on the production division they operated in, all processed raw metals (e.g., copper and aluminium) into half-finished products such as plates, coils, and pipes. Accordingly, group performance was recorded by the company as the amount of the metal processed each month by each group. Comparability of direct performance measures across groups was not possible because groups manufactured different types of products. For example, groups in a copper product division, where over a hundred kinds of copper coiled tubes were manufactured, were responsible for different sets of products, and groups in the melting and casting division operated six copper furnaces with different capacities. To allow for performance comparisons across groups, we computed a performance ratio by dividing monthly group performance for the month of this study by the average monthly performance over the past year for a given task (i.e., groups performing the same task shared the same denominator).

Group efficacy

Two scale formats were used to assess group efficacy: a grid-type and a Likert-type. The grid scale was constructed following Bandura's (2006) guidelines and has been frequently used in previous research (e.g., Earley, 1999; Gibson, 1999; Locke, Frederick, Lee, & Bobko, 1984). This scale presented respondents with 10 levels of achievement customized to specific tasks groups were performing. The 10 levels were determined in discussions with plant managers, using the calculated performance ratios described above. They were arranged in ascending order in the increments of 10% of the average monthly performance of the previous year: from <60% to a challenging 140% or more. For example, groups with the past year's average monthly performance of 100 tons of copper were shown a range of performance levels arranged in ascending order in increments of 10 tons from 'less than 60 tons' to '140 tons or more'. Groups were asked to assess

¹ We did not have full control over the respondent selection process, but we required that they be randomly selected. We explained the importance of random selection, and the plant managers agreed.

whether they believed they could attain each level. Following the discussion of the efficacy measures in Judge, Jackson, Shaw, Scott, and Rich (2007) and Collins and Parker (2010), we also used a Likert-type group efficacy scale with three more fine-grained items. The items were 'I believe that my group can effectively communicate with one another to perform the given task successfully', 'I believe that my group can effectively coordinate one another's work role to perform the given task successfully', and 'I believe that my group can effectively cooperate with one another to perform the given task successfully'.

The results of confirmatory factor analysis (CFA) (described in detail below) supported a single factor structure between the grid item and the three Likert-type items. The four items were thus combined to form a measure of group efficacy. In this transformation, the grid item originally measured with a 10-point scale was converted to a 5-point metric to facilitate interpretation (Edwards, 2001), using the following equation: $X5 = [(X10-1) * (4/9)] + 1$, where $X5$ represents a 1–5 scale, and $X10$ represents a 1–10 scale.

Efficacy antecedents

Past group performance was calculated for the month prior to this study in the same way as group performance described above. Group vicarious learning was measured with three items developed for this study: 'My group has other groups around us from which we can learn useful information regarding our group performance', 'My group often gets useful clues about performance from the work of other groups', and 'My group frequently learns useful performance strategies from other groups'. Group social persuasion was measured with seven items developed for this study. The items were 'Managers often encourage my group that we are capable of achieving our performance goals', 'My group often receives feedback from managers that we can successfully perform given tasks', 'People or other groups tend to call my group a "good" or "effective" group', 'My group tends to be labelled by others as a "bad" group', 'In our group, we encourage one another that we can successfully perform our task', 'My group members typically refer to our group as a "good" group', and 'My group members cheer one another on when performing a tough task'. The first four items reflect social persuasion from outsiders, and the remaining three items capture persuasion from within groups.² Group positive affect was assessed with 10 positive affectivity items from the Positive Affect Negative Affect Schedule (Watson, Clark, & Tellegen, 1988). Consistent with prior research (e.g., Barsade, 2002; Cole, Walter, & Bruch, 2008), instructions for the referent foci being the group and time 'during the past week' were used to capture affect as a group's state-like attribute.

Group trust

This variable was measured with five items from McAllister's (1995) affective trust scale. Some items were modified to reflect the referent focus being the group. For example, the original item, 'I can talk freely to *this individual* about difficulties I am having at work and know that *s/he* will want to listen', was modified as, '*We* (my group members) can talk freely to one another about difficulties we are having at work and know that *we* will be willing to listen'.

² The items for vicarious learning and social persuasion were identified based on a pilot test with 72 undergraduate student groups (362 individuals) working on a semester-long group project. The description of the sample and procedure of the pilot study is available upon request.

Control variables

Given the variation in tasks across the production divisions, we created dummy variables to control for the division each group belonged to. Also, considering the potential implications within-group demographic diversity has for group functioning (Jehn & Bezrukova, 2004; Shin & Zhou, 2007), we included in the analyses heterogeneities in age, gender, and group tenure, as well as average group tenure and the number of respondents.

Aggregation of data

As the level of analysis in this study was the group, data collected from individuals were aggregated to the group level. As described earlier, group efficacy, group positive affect, and group trust are considered emergent group attributes. They correspond to referent-shift consensus models, in which empirical support depends on within-group agreement (Chan, 1998). Group vicarious learning and social persuasion represent groups' collective experiences (Brown, 2003; Prussia & Kinicki, 1996). For these measures, scores from individual members were averaged to form group-level measures. In this type of additive composition, the reliability of additive index (e.g., the mean) is key, and within-group agreement reflects measurement accuracy (Chan, 1998).

We computed r_{wg} statistic for a measure of agreement for each group (James, Demaree, & Wolf, 1993) and two intraclass correlation coefficients, ICC(1) and ICC(2), for measures of relative consistency of responses among the members of groups (Kozlowski & Hattrup, 1992). In calculating r_{wg} , we used the slightly skewed null distribution, in addition to the uniform null, for the potential leniency bias in responses (LeBreton & Senter, 2008). The median r_{wg} across groups for the uniform null was .95 for group efficacy, .85 for group vicarious learning, .90 for group social persuasion, .91 for group positive affect, and .90 for group trust; the median r_{wg} for the slightly skewed null was .93 for group efficacy, .74 for group vicarious learning, .78 for group social persuasion, .82 for group positive affect, and .82 for group trust. ICC(1) is an estimate of the reliability of a single member's ratings of a group phenomenon, and ICC(2) is the expected reliability of the group means. ICC(1) was .29 for group efficacy, .34 for group vicarious learning, .24 for group social persuasion, .32 for group positive affect, and .32 for group trust. ICC(2) was .67 for group efficacy, .71 for group vicarious learning, .61 for group social persuasion, .69 for group positive affect, and .69 for group trust. Taken together, these estimates indicate that aggregating individual responses to the group level was adequate.

Results**Confirmatory factor analyses**

We performed CFA before and after data aggregation, using LISREL 8 [Scientific Software International (SSI), Skokie, IL, USA]. The individual-level data were first subjected to CFA. Five constructs as correlated first-order factors corresponded to a 4-item group efficacy factor, a 3-item group vicarious learning factor, a 7-item group social persuasion factor, a 10-item group positive affect factor, and a 5-item group trust factor. The results supported the factor structure for all constructs with positive and significant item loadings on the designated factors, except for group positive affect. Of the 10 items of group positive affect, the item 'excited' had a negative loading and the item 'alert' had a non-significant loading. An explanation provided by Chinese translators for the negative loading was that the term 'excited' can be interpreted in a negative connotation as 'being stirred

emotionally', which is seen as a sign of immaturity in Chinese culture. After excluding these two items, the goodness-of-fit indices for the five-factor model were $\chi^2 = 945.48$, $df = 314$; the comparative fit index (CFI) = .95; the non-normed fit index (NNFI) = .94; and the root-mean-square error of approximation (RMSEA) = .066. All factor loadings were significant ($p < .01$). These results indicate that the model fitted the data adequately and that the observed variables were reliable indicators of their constructs.

We next examined discriminant validity among the constructs. First, we constrained the latent factor correlation parameter estimate to 1.0 for each pair of factors and performed a series of chi-square difference tests between the constrained and the proposed five-factor model (Anderson & Gerbing, 1988). The chi-square difference test resulted in a significantly worse fit in the constrained model in all 10 possible cases. Second, we checked whether the average squared factor loadings were greater than the squared correlation estimate of any two factors (Fornell & Larcker, 1981), and such was the case for all pairs. These results indicate that distinguishing any two constructs was meaningful in explaining the data, suggesting content differences in the measures.

We reran the CFA and the tests for discriminant validity with the aggregated data. The results were basically identical to those of the individual-level CFA ($\chi^2 = 527.21$, $df = 314$; CFI = .95; NNFI = .95; and RMSEA = .080), with all factor loadings being significant ($p < .01$). Table 1 shows descriptive statistics and correlations for the group-level study variables.

Hypothesis testing

We entered the predictor variables into hierarchical regression analyses in these steps: (1) the control variables; (2) the four group efficacy antecedents and group trust; (3) either the interaction terms between the antecedents and group trust in predicting group efficacy or group efficacy in predicting group performance. The predictor variables were centred before creating the interaction terms (Cohen, Cohen, West, & Aiken, 2003). The results are reported in Table 2.

Hypotheses 1a–4a address the relationships between the four antecedents and group efficacy (Models 1–2). Supporting hypotheses 1a and 3a, the regression coefficients for past group performance ($\beta = .27, p < .01$) and group social persuasion ($\beta = .26, p < .05$) were significant in predicting group efficacy. However, the coefficients for group vicarious learning and group positive affect were not significant, thus not supporting hypotheses 2a and 4a.

Hypotheses 1b–4b pertain to interactions between the efficacy antecedents and group trust (Model 3). For significant interactions, the regression of group efficacy on its antecedents was plotted at a low and a high (i.e., one standard deviation below and above the mean) value of group trust. The coefficient for the interaction between past group performance and group trust was not significant ($\beta = .06, p > .05$), not supporting Hypothesis 1b. The coefficient for the interaction between group vicarious learning and group trust was significant ($\beta = .28, p < .05$). Although the direction of this interaction appears consistent with Hypothesis 2b, the simple slope test revealed an unexpected pattern of results that was different from the prediction, thus not supporting the hypothesis (see Figure 2). That is, the relationship between group vicarious learning and group efficacy was not significant when group trust was high (estimate = .06, $p > .05$), but turned negative and significant when the level of group trust was low (estimate = $-.21, p < .01$). The coefficient for the interaction between group social persuasion and group trust was not significant ($\beta = -.19, p > .05$), not supporting

Table 1. Means, standard deviations, and intercorrelations among study variables

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11
1. Group performance	1.14	.19	—										
2. Group efficacy	4.12	.42	.40**	(.83)									
3. Past group performance	1.16	.22	.62**	.41**	—								
4. Group vicarious learning	3.70	.68	-.01	.21*	.03	(.82)							
5. Group social persuasion	3.91	.56	.05	.45**	.11	.39**	(.74)						
6. Group positive affect	3.72	.59	.20	.49**	.27**	.51**	.48**	(.91)					
7. Group trust	3.89	.51	.16	.54**	.30**	.46**	.56**	.70**	(.83)				
8. Age diversity	4.72	2.66	.05	.02	-.04	.00	.19	.07	-.09	—			
9. Gender diversity	.24	.27	.13	-.01	-.05	-.20	-.18	-.35**	-.28**	.16	—		
10. Tenure diversity	1.54	.95	.10	.06	-.01	.19	.20	.24*	.08	.52**	-.26*	—	
11. Group tenure	3.03	1.49	-.10	.17	-.12	.14	.20*	.21*	.10	.35**	-.18	.59**	—
12. Respondent size	4.80	1.69	-.02	-.16	-.22	.06	.05	.10	-.07	.32**	.15	.12	.10

Note. $n = 100$. Scale internal consistency reliabilities are shown in parentheses on the diagonal for multiple-item measures. Dashes indicate that the values are not applicable.

* $p < .05$; ** $p < .01$.

Table 2. Summary of regression analysis results

Predictor variables	Group efficacy			Group performance		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age diversity	.00	-.02	-.09	.00	-.01	.00
Gender diversity	.03	.18	.18	.12	.22*	.17
Tenure diversity	-.11	-.04	-.01	-.06	.16	.18
Average group tenure	.14	.15	.15	-.31*	-.16	-.20
Respondent size	-.26*	-.20*	-.25**	.05	.16	.20*
Past group performance		.27**	.29**		.65**	.57**
Group vicarious learning		-.17	-.15		-.02	.03
Group social persuasion		.26*	.28*		.16	.05
Group positive affect		.29	.25		.03	-.05
Group trust		.21	.19		.04	-.01
Past group performance × group trust			.06			
Group vicarious learning × group trust			.28*			
Group social persuasion × group trust			-.19			
Group positive affect × group trust			-.28*			
Group efficacy ΔR^2		.37**	.07*		.35**	.25*
$R^2 (R^2_{adj})$.17 (.05)	.54** (.44)	.61** (.50)	.18 (.07)	.53** (.42)	.56** (.45)

Note. Standardized coefficients are reported. Division dummies were included in all models.

* $p < .05$; ** $p < .01$.

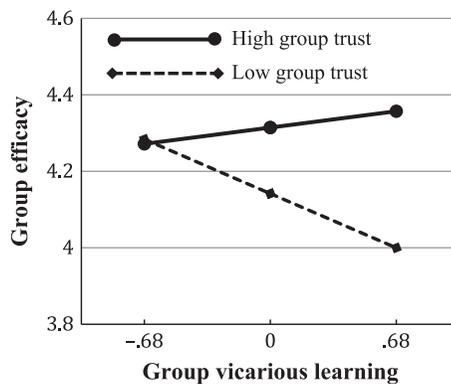


Figure 2. Group trust and group vicarious learning interaction for group efficacy.

Hypothesis 3b. Finally, the interaction coefficient between group positive affect and group trust was negative and significant ($\beta = -.24$, $p < .05$), thereby supporting Hypothesis 4b of compensatory moderation. As displayed in Figure 3, the positive relationship between group positive affect and group efficacy, which was not significant at the high level of group trust (estimate = .04, $p > .05$), became significant as group trust decreased to the low level (estimate = .32, $p < .01$).

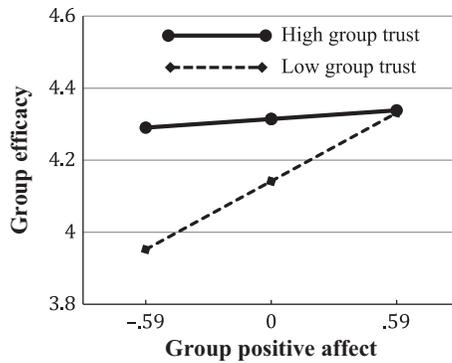


Figure 3. Group trust and group positive affect interaction for group efficacy.

Models 4–6 tested the incremental validity of group efficacy in predicting subsequent group performance. Supporting Hypothesis 5, the relationship between group efficacy and group performance was positive and significant ($\beta = .25, p < .05$), even after controlling for all other predictor variables (Model 6).

To further substantiate these results, we examined the conditional indirect effects (Edwards & Lambert, 2007; Preacher, Rucker, & Hayes, 2007) of the efficacy antecedents on group performance through group efficacy across different levels of group trust. Obtained although Hayes’ (2013) PROCESS program with the bootstrapping method, the results corroborated those from regression analyses (Table 3). The indirect effect of group vicarious learning was negative and significant under low group trust but not significant under high group trust. Also, the indirect effect of group positive affect was positive and significant under low group trust but not significant under high group trust. For past group performance and group social persuasion, the indirect effects did not include zero within their confidence intervals under high or low group trust, although the effect sizes decreased as the level of group trust increased.

Discussion

This research contributes to a more complete understanding of group efficacy formation and demonstrates the relevance of group trust in the development of group efficacy in work groups. We found that trust is a subtle, yet significant factor for group effectiveness,

Table 3. Conditional indirect effects

	Group trust level	Indirect effect	SE	LL 95% CI	UL 95% CI
Past group performance	High	.058*	.036	.007	.156
	Low	.069*	.056	.001	.222
Group vicarious learning	High	-.007	.010	-.029	.010
	Low	-.016*	.011	-.051	-.001
Group social persuasion	High	.026*	.019	.001	.077
	Low	.038*	.025	.002	.104
Group positive affect	High	.009	.013	-.010	.046
	Low	.028*	.019	.001	.085

Note. * $p < .05$.

as indicated by the multiple patterns of interaction with the efficacy antecedents in the formation of group efficacy. These findings answer the question 'How does trust contribute to organizational effectiveness?' by showing that group trust contributes to the development of group efficacy.

We examined for the first time the four antecedents of group efficacy concurrently in a business organization. Given the covariation among the four antecedents, focusing on a particular antecedent can result in an overstatement of its importance, leaving much unsaid about systematic evaluation of the relationships between these four antecedents and group efficacy. By conceptualizing the moderating role of group trust in the multivariate model of group efficacy formation, we offer a more nuanced understanding of group efficacy formation at work.

Consistent with the predictions made in social cognitive theory, significant relationships for past group performance and group social persuasion with group efficacy were observed, prior to considering group trust. Differently from the predictions, however, group vicarious learning and group positive affect were not related to group efficacy. When group trust was included in the model, the pattern of the relationships between the four antecedents and group efficacy was no longer as straightforward as was posited by Bandura (1982, 1986, 1997). In a *post-hoc* analysis with median-split subsamples of high and low group trust, past group performance was the only significant predictor of group efficacy when group trust was high. Given these findings, a sceptic may conclude that three of the four initially conceptualized antecedents of group efficacy do not matter much if group trust is high. This could be a consequential finding, both for theoretical parsimony and for managerial application.

The story of the four efficacy antecedents turns even bleaker when group trust is low. The interaction of group vicarious learning with group trust indicated that its relationship with group efficacy varies depending on the level of group trust but not in the way expected. The relationship was not significant when group trust was high, but it turned negative and significant when group trust was low. This could imply that when group members do not trust one another, observing other well-performing groups only highlights the differences between their own group and the model group(s), leading the non-trusting members to dwell on the differences, as opposed to learning from others.

The complexity of interaction continues with group positive affect. As with group vicarious learning, only the interaction with group trust was significant. However, the pattern of interaction was different from that of group vicarious learning. The relationship between group positive affect and group efficacy was positive and significant under low trust, but not significant under high trust. This implies that a high level of group trust may not leave much room for group affect to make any significant difference in the members' shared belief in their collective capabilities, but that a low level of group trust has relatively greater potential for more transient affective cues. It could be that in a group with low trust, cognitive information conveyed by the other antecedents causes cognitive dissonance in the members because they know that they cannot trust one another. However, a relatively positive affective climate in the group at a given point in time may come into play without much conscious awareness, making it less likely to create severe cognitive inconsistency with what they already know about their group by experience. Although low group trust combined with highly positive group affect is rare, it remains important to recognize the benefits of creating positive group affect in managing group efficacy.

Another contribution of this study concerns the predictive validity of group efficacy. Whereas most previous studies conducted in organizations have relied on members' self-

ratings or supervisors' subjective appraisals as performance indicators (e.g., Gibson, 1999; Little & Madigan, 1997), this research used objective performance measures from company records. Self-ratings of performance tend to be inflated, and supervisors' performance ratings, albeit more reliable than self-ratings, are, too, prone to biases (Fecteau & Craig, 2001). The use of objective company records provided a more reliable performance indicator, contributing to the construct validity of the criterion measure. Moreover, the relationship between group efficacy and group performance was assessed after controlling for past group performance. Given that past performance can itself be affected by efficacy beliefs, considering it as an antecedent of group efficacy may result in statistical overcontrol, which removes some of the effects of the determinants of past performance (e.g., group efficacy). Thus, controlling for past group performance in assessing the relationship between group efficacy and group performance is a conservative approach for estimating the relationship, increasing the statistical conclusion validity of the findings we reported.

Limitations and future research

First, we aggregated individual-level data to assess group-level constructs. These aggregates are not group-level measures *per se*, but rather represent substitutes of group-level measures. Thus, we used a multitude of statistical analyses to support aggregation of our measures to the group level. Future research could use an alternative way to assess group efficacy such as the group discussion method (e.g., Kirkman, Tesluk, & Rosen, 2001), although this approach is liable to the drawbacks of group decision-making (see Bandura, 1997).

Next, the necessity of this manufacturing plant to continue to operate as normal limited us to obtaining responses from approximately half of the work group members. Although plant managers randomly chose the respondents, data from half of the total members might not adequately capture the properties of a group as a whole. In addition, prior month performance was used as a basis for operationalizing past group performance. As performance can fluctuate due to factors that are not informative of a group's efficacy, future research should consider measuring past performance over a more extended time period.

Finally, our findings point to the need for more research on the formation of group efficacy. Examining the effect of task novelty may be a fruitful avenue for future research in clarifying our findings. Although the groups in our sample were performing tasks involving skill varieties and often hazardous procedures, they may have gained substantial mastery experiences with their tasks over time, and the role of each antecedent may have changed as a consequence. For example, group vicarious learning may exert a significant effect on group efficacy for groups with little enacted experience, but little effect for those with more experience. Similarly, the degree of performance outcome that is observable or objectively measurable may also affect the relative effects of the efficacy antecedents. When the group performance outcome is less observable and more difficult to objectively measure, it may be that past group performance has less influence whereas group vicarious learning, group social persuasion, and group affect have greater influences. Additionally, the level of group development or group longevity could be considered. Prolonged group performance allows time to develop trust (or distrust) among group members, but short-term groups may not have enough time to build group trust, which could mean that the influences of group vicarious learning, group verbal persuasion, and group affect in group efficacy formation are more pronounced.

Practical implications

Our results indicate that group trust plays an important role in the formation of group efficacy. Further, our findings suggest that group vicarious learning, group social persuasion, and group affect may not add variance in predicting group efficacy in the presence of high group trust. This highlights the significance of building trusting relationships in work groups. To better manage group performance, organizations should view trust as a source of competitive advantage to be structured, managed, and perhaps institutionalized for organizational effectiveness, not as something that comes naturally. Furthermore, our findings corroborate research that suggests group efficacy as a key predictor of group performance, this time with the four efficacy antecedents and group trust controlled for in a manufacturing setting. This reinforces the applicability of building and maintaining high levels of group efficacy in the workplace and renders added relevance for organizations operating, or attempting to, in China.

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