ScholarOne - Negative Affect and Team Innovation: The Nonlinear Moderating Role of Team Mindfulness

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Abstract

Teams will inevitably experience negative affects when performing innovative tasks. Negative group affect would not necessarily lead to negative team outcomes. Drawing on theories of mood-as-information and mindfulness, we propose that team mindfulness will nonlinearly moderate the relationship between negative group affective tone and team innovation through the mechanism of external knowledge acquisition. We collected data from 76 research and development teams to test our hypotheses. Results indicated that 1) NGAT is positively related to external knowledge acquisition when team mindfulness is at the medium level, 2) external knowledge acquisition is positively related to team innovation, and 3) NGAT is beneficial for team innovation via external knowledge acquisition when team mindfulness is at the medium level, rather than low or high level. Theoretical and practical implications are discussed.
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ABSTRACT

Teams will inevitably experience negative affects when performing innovative tasks. Negative group affect would not necessarily lead to negative team outcomes. Drawing on theories of mood-as-information and mindfulness, we propose that team mindfulness will nonlinearly moderate the relationship between negative group affective tone and team innovation through the mechanism of external knowledge acquisition. We collected data from 76 research and development teams to test our hypotheses. Results indicated that 1) NGAT is positively related to external knowledge acquisition when team mindfulness is at the medium level, 2) external knowledge acquisition is positively related to team innovation, and 3) NGAT is beneficial for team innovation via external knowledge acquisition when team mindfulness is at the medium level, rather than low or high level. Theoretical and practical implications are discussed.

Key words: Negative group affective tone; team creativity; team mindfulness; team external knowledge acquisition; nonlinear moderation effect
INTRODUCTION

In the dynamic and equivocal environments, organizations worldwide have increasingly leveraged teams, rather than individuals, to perform innovative tasks as teams can access and synthesize diversified knowledge from multiple sources to produce innovative solutions (Knippenberg, 2017; Parke et al., 2022). Thus, team innovation is becoming more valued for the success of contemporary organizations. As such, researchers have attempted to understand the factors that will promote or inhibit team innovation (Choi et al., 2022; van Knippenberg, 2017; Zhang et al., 2022). When performing innovative tasks, team members will inevitably and diffusely experience various affects, such as depression and disappointment when encountering difficulties and setbacks, and joy and excitement when facing progress and achievement. Thus, group affect tone has been identified as one of the key factors that will influence team innovation (Tsai et al., 2012; Chi and Lam, 2022).

Group affective tone, defined as “consistent or homogeneous affective reactions within a group” (George, 1990, p. 108), generally is composed with two aspects: positive group affective tone (PGAT) and negative group affective tone (NGAT). PGAT and NGAT have been conceptualized as distinct dimensions of group affective tone as they results from different antecedents and may influence team processes and outcomes in unique ways (George, 1990; George and King, 2007; Tsai et al., 2012). Although negative affects do converge more easily within a group than positive affects due to the significance of negative information and events in interpersonal settings (Cacioppo et al., 1997; Bartel and Saavedra, 2000; Watson and Clark, 1984), existing research on group affective tone has primarily focused on the beneficial effect of PGAT on team innovation through broadened attention,
flexible information processing and smooth communication (Tsai et al., 2012; Shin, 2014; Shin et al., 2019). NGAT has not received anywhere near as much attention as PGAT in the literature, with inconsistent arguments and mixed findings concerning how NGAT influences team innovation. On one hand, George and King (2007) and Spoor and Kelly (2004) suggested that NGAT implies the situation is problematic, and thus NAGT has the potential to promote team innovation by shifting team members’ attention to the problems in the environment and calling for solutions for that problem, which is consistent with the findings of Schwarz and Bless (1991) and Kooij-Bode et al. (2010). Rhee (2007), on the other hand, theoretically proposed that NGAT would inhibit social interactions among team members, resulting in reduced team morale and team performance. Meanwhile, no significant relationship between NGAT and team innovation was found in student groups in the study of Grawitch et al (2003). In a recent study, Chi and Lam (2022) found that NGAT is beneficial for team creativity when the team is equipped with learning goal orientation. Thus, scholars have called for a contingent perspective regarding the effect of NGAT on team innovation (Barsade and Knight, 2015; Knippenberg, 2017; Chi and Lam, 2022). Motivated as such, the current study aims to investigate the conditions under which NGAT will be conducive to team innovation, along with figuring out the mechanisms underlying the relationship between NGAT and team innovation.

To fulfill the above research goal, we first leveraged mood-as-information theory to identify how NGAT influences team innovation. According to the mood-as-information theory (Schwarz and Clore, 2003), negative affect indicates that the situation is challenging, which triggers more externally-focused and accommodative way of information processing,
e.g., alteration of existing internal structures (e.g., ideas or perspectives) in accordance with external environments (Bless and Fiedler, 2006). Thus, external knowledge acquisition is the key mechanism that transits the potentially beneficial informative effect of NGAT on team innovation. However, this positive effect of NGAT on team innovation via external knowledge acquisition can only be reaped when the team can successfully handle the unpleasant and stressful emotional aspect of NGAT (Chi and Lam, 2022). Therefore, based on theories of mindfulness, we further propose that team mindfulness, which emphasizes awareness and attention to the current state (Brown and Ryan, 2003; Yu and Zellmer-Bruhn, 2018), can help team members to regulate their emotions and disentangle their cognition from their emotional experience (Hülsheger et al., 2013) in a nonlinear way. As such, team mindfulness can serve as the contingent factor that will bring out the beneficial effects of NGAT on team innovation through external knowledge acquisition.

This study contributes to the literature in the following ways. First, we investigated how to steer NGAT towards the goal of team innovation. This focus on NGAT is theoretically in line with a more general trend in research to increasingly emphasize the role that affect plays in organizational behavior (e.g. Elfenbein, 2007; Barsade and Knight, 2015; Knippenberg, 2017; Parke et al., 2022). Meanwhile, figuring out how NGAT influences team innovation is also of critical practical significance because NGAT is an inevitably diffusive experience for teams undertaking innovative tasks. We argue that teams with moderate level of collective mindfulness are able to regulate the emotional aspects of NGAT and bring out the potentially beneficial informative role of NGAT on team innovation. By doing so, we reconcile seemingly discrepant viewpoints concerning the effect of NGAT on team innovative
outcomes (George and King, 2007; Kooij-Bode et al., 2010; Rhee, 2007) and answers the call for teasing apart the nuanced effects of group affective tone on team outcomes (Barsade and Knight, 2015; Chi and Lam, 2022).

Second, we revealed the mediating role of external knowledge acquisition in the relationship between NGAT and team innovation. The previous research examining the transitting mechanism through which group affective tone affects team outcomes has primarily focused on team internal processes and states, such as knowledge sharing (Chi and Lam, 2022), team reflexivity (Shin et al., 2019; Shin, 2014) and team motivation, i.e., team promotion/prevention focus (Shin, 2014). By exploring the mediation mechanism of external knowledge acquisition, this study not only opens up the black box in the relationship between NGAT and team innovation, but also complements the previous literature on group affective tone from the internal perspective, and thus providing an enriched understanding on the mediation mechanisms through which NGAT influences team innovation.

Finally, we examined the nonlinear moderating role of team mindfulness in the relationship between NGAT and team innovation. Literature on mindfulness has generally verified its positive effect on individuals’ well-being and performance (Good et al., 2016; Kay and Skarlicki, 2020). However, researchers have contended that there is an inherent contradiction between mindfulness and innovation, that is while mindfulness emphasizes being content with the status quo, innovation is inspired to change the status quo, and thus how mindfulness will influence innovation is ambiguous (Good et al., 2016; Hafenbrack and Vohs, 2018). The present study proposed and empirically found that moderate level of team mindfulness is helpful in bringing out the beneficial effect of NGAT on team innovation,
while low or extremely high level of team mindfulness is not. By doing so, we shed light on a more careful understanding of role of team mindfulness on team innovation.

The remaining section is organized as following. We first reviewed the ambivalent effect of NGAT on team external knowledge acquisition and team innovation, and we discussed the theoretical background of team mindfulness. Then, we developed the hypotheses, followed by research methods and data analysis results. Finally, findings and their implications for theory and practices were discussed.

THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

Ambivalent Effect of NGAT on Team External Knowledge Acquisition and Innovation

Group affective tone generally refers to the homogeneous affective state shared by team members (Tsai et al., 2012; Shin et al., 2019). Scholars have found that the formation of group affective tone basically results from emotional contagion among team members (Barsade and Knight, 2015; Chi and Lam, 2022). Specifically, the emotional contagion perspective has suggested that as team members engage in intensive interaction during the process of task completion, automatic and subconscious emotional transfer easily occurs among team members via facial expressions, voice tone, and body movements in their interaction, leading to affective convergence in teams (Barsade, 2002; Chi et al., 2011), which will subsequently exert important effects on team processes and outcomes (Barsade and Knight, 2015; Shin et al., 2019).

Consistent with research on emotions and affects at the individual level, group affective tone can be classified into two categories, PGAT and NGAT (George, 1990; George and King, 2007). PGAT refers to the extent to which team members consistently experience
positive affects while NGAT is the extent of shared negative affects experienced by team members. Compared with positive affects, negative affects are more likely to converge at the team level as negative information and events are much easier to be noticed especially in the interpersonal situation (Cacioppo et al., 1997; Bartel and Saavedra, 2000). However, the current research on the group affective tone has primarily focused on the beneficial effect of PGAT on team innovation through divergent thinking, enhanced motivation and intensified social interactions (Grawitch et al., 2003; Tsai et al., 2012).

Compared with PGAT, the effect of NGAT on team innovation is complex and ambiguous. Existing studies show that NGAT has an ambivalent effect on team external knowledge acquisition and team innovation. The theory of mood-as-information suggests that mood informs about the nature of a situation (Schwarz and Clore, 2003). Specifically, negative affect signals that the situation is problematic and thus individuals need to endeavor extra efforts to search for and process information to address the problematic situation. In addition, NGAT encourages bottom-up information processing style (Bless and Fiedler, 2006), which is evidence-driven but not preference-driven (Hastie and Pennington, 1991). The information processing style triggered by NGAT impels team members to focus on external/situational information relevant to the issue at hand, elaborate the collected information at both individual level and team level till the innovative solution of the problem and adjust internal structures, such as attitudes, beliefs and preferences, to fit new information assembled from the environments (Bless, 2001; Fiedler, 2001; Bless and Fiedler, 2006). Chi and Lam (2022) also have empirically verified that when the team is much more learning goal orientated, NGAT prompts team members to exchange more information, which is
favorable for the team creativity. However, Tsai et al. (2012) and Rhee (2007) argued that NGAT can negatively affect team process and innovative output by trapping team members in emotional distress and even exhaustion. Thus, the effect of NGAT on team processes and outputs depends upon whether the situational factors are conducive to bring out the positive informative function of NGAT (Mitchell et al., 2014; Barsade and Knight, 2015). We propose that one of the most important contextual factors to reap the informative effects of NGAT is team mindfulness due to the its role in regulating emotions (Hülsheger et al., 2013; Yu and Zellmer-Bruhn, 2018).

Figure 1 presents the conceptual framework of the current study.

Figure 1. Conceptual Framework

The Curvilinear Moderating Role of Team Mindfulness in the Relationship Between NGAT and Team External Knowledge Acquisition

The concept of mindfulness, which emphasizes awareness and attention to the current state, can be traced back to Buddhism (Brown and Ryan, 2003; Good et al., 2016). In the early years, mindfulness has been primarily applied and studied in the field of clinical psychiatry (e.g., Kabat-Zinn, 2003). Management scholars have gradually demonstrated surging interests in mindfulness in recent years due to the prevalence of mindfulness training programs in enterprises such as Google, Aetna and Alibaba (Hafenbrack et al., 2019; Liu et
al., 2020; Wolever et al., 2012). Research has found that individual mindfulness is appears to have broadly beneficial impacts on employee well-being and performance, meanwhile with a call for the examination of how team mindfulness affects teamwork (Good et al., 2016). Team mindfulness refers to “a shared belief among team members that team interactions are characterized by awareness and attention to present events, and by experiential, nonjudgmental processing of within-team experiences” (Yu and Zellmer-Bruhn, 2018, p.326). Although the development of team mindfulness is based on individuals’ mindfulness, it is not the simple sum of mindfulness of individual members. It is a shared perception about the mindfulness state of the team produced by team members during the interaction process (Yu and Zellmer-Bruhn, 2018; Liu et al., 2020). Team mindfulness consists of two dimensions, present focused-attention and experiential information processing (e.g., Brown and Ryan, 2003; Davidson and Kaszniaak, 2015; Good et al., 2016; Yu and Zellmer-Bruhn, 2018). The first dimension refers to subject’s sustained and concentrated attention to what is happening at this moment consciously and purposefully, rather than paying attention to possible future or past experiences. The second dimension refers to the subject’s open, and experiential way of processing, without judging or labeling observed facts or information. We expect that team mindfulness will moderate the relationship between NGAT and team innovation.

First, mindfulness can function to regulate emotions (Hülsheger et al., 2013; Sutcliffe et al., 2016). Based on resource conservation theory (Hobfoll, 1989), individuals have a tendency to avoid negative experiences and emotions. As a result, team members may tempt to flee when faced with the NGAT. The experiential and non-judgmental way of processing emphasized by mindfulness help team members reduce the heuristic avoidance towards
negative emotions and accept the current subjective experience (Brown et al., 2007) (Glomb et al., 2011). Thus, mindfulness can help team members decouple their cognition from the emotional experience, thereby reducing the interference of negative emotions on task completion. As such, team members can keep their cognitive resources to address present challenging cues from the environment conveyed by NGAT.

Second, mindfulness improves team members’ prosocial motivation (Hafenbrack et al., 2019). Prosocial motivation encourages team members to pay attention to the needs of others in the team (Grant and Berry, 2011). In order to better understand the ideas and meet the needs of other members, team members will conduct additional information search from both internal and external sources. Further, prosocial motivation helps to improve the sense of trust and psychological safety among team members. To identify and solve the problems conveyed by NGAT, team members will carry out active communication and discussions to discuss whether the team goals match the current environment. In the atmosphere of caring about others and helping each other induced by team mindfulness, NGAT becomes a trigger for the team to search for more external knowledge and information.

However, high level of team mindfulness will be not helpful. A main aim of mindfulness is to get people to accept their status quo (Bishop et al., 2004). Therefore, even if NGAT signals that the environment is problematic, teams with high level of mindfulness will merely accept their current state, without motivation to perform in an innovative manner (Hafenbrack et al., 2019). Thus, we propose:

*Hypothesis 1: Team mindfulness curvilinearly moderates the relationship between NGAT and team external knowledge acquisition, such that the relationship is more positive when team*
mindfulness is at the medium level, compared with when team mindfulness is low or high.

The Effect of External Knowledge Acquisition on Team Innovation

Team innovation essentially involves the development and application of novel ideas, which links knowledge elements that have not been associated previously, by the team(Knippenberg, 2017). Assembling knowledge from external sources enlarges the knowledge pool of the team, which increase the possibility to generate novel ideas by building new linkage (Zellmer-Bruhn, 2003). Further, the acquired external knowledge provides opportunities for team members to reflect upon their current obsolete or inappropriate cognitive framework with current market and technical situations and then make adaptations accordingly with novel ideas (Zhou and Li, 2012; Qu and Liu, 2017). In addition, external sources may also provide support for the application of novel ideas (Ancona and Caldwell, 1992). In a meta-analysis, Hülsheger et al. (2009) found that external communication of the team was positively related to generation of innovative ideas. Thus, we propose Hypothesis 2.

Hypothesis 2: Team external knowledge acquisition is positively related to team innovation.

The Mediating Role of Team External Knowledge Acquisition

Team mindfulness helps teams to bring out the positive informative effect of NGAT and impel team members to endeavor efforts to search and process information from the environment and make corresponding adaptations. Thus, the interactive term of NGAT and team mindfulness is positively related to team external knowledge acquisition. Then external knowledge acquisition will urge team members to break routines and understand the task from a new perspective, thus facilitating the generation of novel ideas that combine
seemingly unrelated elements. Based on the above arguments and Hypothesis 1 and Hypothesis 2, we propose Hypothesis 3.

*Hypothesis 3*: Team external knowledge acquisition mediates the interactive effect of NGAT and team mindfulness on team innovation.

**METHOD**

**Participants and Data Collection**

Participants in this research were research and development (R&D) teams in organizations as R&D work involves great amount of innovation. With the help of a university MBA supervisor who introduced this survey to the top management, we accessed 82 R&D teams in several companies in China across a wide range of industries including software development, transportation tools design, and home appliances design. Data were collected from two different sources in order to reduce common method bias (CMB, Podsakoff et al., 2003). Thus, two questionnaires were designed. Questionnaire 1 is filled by team members, consisting of questions related to their demographic information, affective experience in the team (PGAT and NGAT), team mindfulness and team external knowledge acquisition. Questionnaire 2 is filled by the team leader to provide basic information about the team, such as the team longevity (in month) and team size, and rate team innovative performance. We distributed questionnaire 1 to 410 members and questionnaire two to 79 team leaders, respectively. To guarantee the quality of the questionnaire, we promised anonymity of the survey to all participants. We also included a trap question (“please select 2 for this question”) in the survey to filter answered questionnaires with low quality. To match team members with their team leader, the questionnaires were distributed by the researchers...
on site. All questionnaires were collected immediately after participants finished the survey.

We finally received questionnaires from 76 team leaders and 364 team members, with an overall response rate of 90.53%, which is reasonable due to the support from the top management and the on site data collection method. After discarding questionnaires from the participants who failed the trap question, the final sample was 76 teams, with 352 team members and 76 team leaders. For the participants of team members, 73.16% were male and the average age was 29.78 (SD=6.42). For the participants of leaders, 92.11% were male and the average age was 38.39 (SD=5.03). The average team size was 5.60, ranging from 4 to 12 reported by team leader.

**Measures**

All the variables were measured by 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). Measurement items were adapted from previous studies that have established scales in place to ensure validity and reliability. Minor adjustments were made to ensure that the items were appropriate in the research context. As the participants in the current study were Chinese, we adopted the back-translation procedure (Brislin, 1980) to make sure that English and Chinese versions of the scale were comparable and compatible.

*Team innovative performance.* The scale of team innovative performance was from the Pirola-Merlo and Mann (2004), including four items. Sample item is “Our team’s recent output is creative”. Coefficient of the internal consistency $\alpha=0.95$.

*NGAT.* The measurement of NGAT adopts shorted version of PANAS (Watson et al., 1988) which has gained validity in previous research (Thompson, 2007; Mitchell et al., 2014). Following these studies, we stressed that the measure was in the team setting, rather than
generally experienced, and therefore aimed to reflect team affect (Cole et al., 2008). Besides, we framed the time “during last week to now” as George and Zhou (2002, 2007) did. The alpha coefficient for NGAT was 0.877, ICC(1) was 0.34 and ICC(2) was 0.69.

**Team mindfulness.** The scale of team mindfulness was derived from Yu and Zellmer-Bruhn (2018), including ten items for two dimensions. Sample item is “it is difficult for the team to stay focused on what is happening in the present” for the dimension of present-focused attention and “the team is aware of thoughts and feelings without over-identifying with them” for the dimension of experiential, nonjudgmental processing. The alpha coefficient for team mindfulness was 0.92, ICC (1) was 0.23 and ICC (2) was 0.58.

**Team external knowledge acquisition.** Team external knowledge acquisition was measured with six items from Mitchell (2006) and Ancona and Caldwell (1992). Typical item is “our team spends time and efforts in finding out what competing firms or teams were doing on similar projects”. The alpha coefficient for external knowledge acquisition was 0.94, ICC (1) was 0.27 and ICC (2) was 0.63.

**Control Variables.** Control variables include team size, team tenure (in month) reported by the team leader and PGAT, which was also measured by the shorted version of PANAS (Thompson, 2007). The alpha coefficient for PGAT was 0.89, ICC (1) was 0.35 and ICC (2) was 0.71. In addition, we also controlled for team diversity, including age diversity, gender diversity and expertise diversity, as previous studies have verified the importance of team diversity for team innovation. Age diversity was measured with the standard deviation of team members’ age, and gender diversity and expertise diversity were calculated with Blau’s (1977) index with the algorithm of $D = 1 - \sum p_i$, where $p_i$ refers to the proportion of...
DATA ANALYSIS AND RESULTS

A three-step approach was adopted to analyze the data. First, we first performed confirmatory factor analysis (CFA) to test the validity and reliability of the scale. Second, an aggregation test was conducted to assess whether it is appropriate to aggregate the data reported by individual members to measure the team level constructs. Finally, data analysis results of ordinary least square (OLS) were reported.

Confirmatory Factor Analysis

We first conducted confirmatory factor analysis (CFA) using the data at individual level for the variables of NGAT, PGAT, team mindfulness, team external knowledge acquisition and team innovative performance. The results of CFA indicated that a five-factor model ($\chi^2$/df=1.28, RMSE=0.06, CFI=0.93) fits better than a four-factor model ($\chi^2$/df=3.57, RMSE=0.16, CFI=0.75) and other models.

We further assessed the reliability and validity of all variables. Reliability assesses internal-item consistency with the index of Cronbach’s alpha (Nunnally, 1975). The Cronbach’s alpha of all variables exceeds 0.70 shown in Table 1, suggesting satisfied reliability. Construct validity refers to the extent to which the items on a scale measure the intended theoretical construct, including convergent validity and discriminate validity (Campbell and Fiske, 1959; Fornell and Larcker, 1981). All the factors load well on their respective latent variables as all the values of factor loadings exceed the threshold of 0.7 and the values of AVE are above 0.50 (shown in Table 2), confirming good convergent validity. Table 2 also shows that the the values of square root of AVE are greater than the correlations
between the focal variable and other variables, providing strong evidence of satisfied discriminant validity.

**Data Aggregation**

As the data of team variables were collected from individual participants, it is necessary to test whether it is appropriate to average individuals’ responses to represent team level variables, using indicators of $r_{wg}$ (James et al., 1993) and intra-class correlation (ICC) (Bliese, 2000). The indicator of $r_{wg}$ measures the degree of the consensus among team members in each team (Chan, 1998; Kozlowski and Klein, 2000). ICC has two indicators, ICC1 and ICC2, where the former measures the between-group variance in individual responses and the latter serves as the reliability assessment of group-level means. The results of the three aggregation indicators are shown in Table 1.

<table>
<thead>
<tr>
<th>Variables</th>
<th>$R_{wg}$ (min)</th>
<th>ICC (1)</th>
<th>ICC (2)</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>NGAT</td>
<td>0.81</td>
<td>.34</td>
<td>0.70</td>
<td>0.92</td>
</tr>
<tr>
<td>Team mindfulness</td>
<td>0.74</td>
<td>.23</td>
<td>0.58</td>
<td>0.87</td>
</tr>
<tr>
<td>External knowledge acquisition</td>
<td>0.72</td>
<td>.27</td>
<td>0.63</td>
<td>0.90</td>
</tr>
<tr>
<td>PGAT</td>
<td>0.79</td>
<td>.35</td>
<td>0.71</td>
<td>0.95</td>
</tr>
<tr>
<td>Team innovative performance</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.89</td>
</tr>
</tbody>
</table>

The results in Table 1 show that the minimum value of $r_{wg}$ for each variable is greater than 0.70, and the values of ICC1 of all variables exceed the threshold of 0.12. The values of ICC2 are greater than 0.6 for all variables except team mindfulness. The value of ICC2 is greatly influenced by the average team size. As the average team size ($K=4.63$) is rather small in the sample of this study, the ICC2 of team mindfulness, which is close to 0.6, is comparable to the value of ICC2 reported in the previous literature (Zhang et al., 2013). Therefore, it is appropriate to aggregate the data collected from individual members to the
represent the team level variables.

**Descriptive Statistics**

The descriptive statistics of all variables are shown in Table 2, including mean, standard deviation and correlations among variables.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.Team Size</td>
<td>8.2</td>
<td>1.49</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Team Tenure (Month)</td>
<td>40.05</td>
<td>33.65</td>
<td>-.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Gender Diversity</td>
<td>.36</td>
<td>.18</td>
<td>.11</td>
<td>.1</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Age Diversity</td>
<td>.42</td>
<td>.19</td>
<td>.08</td>
<td>.14</td>
<td>-.02</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Expertise Diversity</td>
<td>.38</td>
<td>.19</td>
<td>.08</td>
<td>-.01</td>
<td>.09</td>
<td>.05</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.PGAT</td>
<td>4.55</td>
<td>.71</td>
<td>-.09</td>
<td>.05</td>
<td>.12</td>
<td>.08</td>
<td>.01</td>
<td>.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.NGAT</td>
<td>2.25</td>
<td>.69</td>
<td>-.14</td>
<td>.10</td>
<td>.03</td>
<td>.06</td>
<td>-.04</td>
<td>-.25</td>
<td>.77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.Team Mindfulness</td>
<td>4.83</td>
<td>.91</td>
<td>-.032</td>
<td>-.16*</td>
<td>.00</td>
<td>.07</td>
<td>.27*</td>
<td>-.12</td>
<td>.77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.Knowledge Acquisition</td>
<td>4.29</td>
<td>.75</td>
<td>.143</td>
<td>-.11</td>
<td>.01</td>
<td>.06</td>
<td>.12**</td>
<td>-.01</td>
<td>.49**</td>
<td>.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.Team Innovation</td>
<td>5.27</td>
<td>.84</td>
<td>.09*</td>
<td>-.12</td>
<td>-.05</td>
<td>-.07</td>
<td>.06</td>
<td>.15*</td>
<td>-.12</td>
<td>.49**</td>
<td>.57**</td>
<td>0.72</td>
</tr>
</tbody>
</table>

Notes: * for p<0.05, ** for p<0.01. The values in bold on the diagonal are the square root of AVE.

The results showed that the average value of NGAT is 2.25, a low-to-medium level. This observed level of NGAT is quite reasonable as would be expected from a mentally healthy population because organizations would punish or even dismiss the team that is experiencing extreme high NGAT in order to manage team morale (George, 1990). In addition, the highest inter-factor correlation is 0.57 (between external team knowledge acquisition and team innovative performance) lower than the threshold of 0.65, an indication of low probability of the occurrence of multicollinearity problem (Tabachnick and Fidell, 1996).

**Hypotheses test**

Hierarchical regression analysis was adopted to test the hypotheses in SPSS 20.0. In
performing regression, we mean-centered all the variables to minimize the threat of multicollinearity in equations where we included interaction terms. Table 3 presents the hierarchical regression analysis results.

**TABLE 3. Hierarchical regression analysis results**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Team innovative performance</th>
<th>External knowledge acquisition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td><strong>Controls</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team size</td>
<td>-.08</td>
<td>-.02</td>
</tr>
<tr>
<td>Team tenure</td>
<td>-.10</td>
<td>-.09</td>
</tr>
<tr>
<td>Gender diversity</td>
<td>-.02</td>
<td>-.01</td>
</tr>
<tr>
<td>Age diversity</td>
<td>-.24**</td>
<td>-.19*</td>
</tr>
<tr>
<td>Expertise diversity</td>
<td>.13</td>
<td>.11</td>
</tr>
<tr>
<td>PGAT</td>
<td>.32**</td>
<td>.25**</td>
</tr>
<tr>
<td><strong>IV and Moderator</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NGAT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team mindfulness</td>
<td>-.12</td>
<td>.09</td>
</tr>
<tr>
<td><strong>Interaction term</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NGAT*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team mindfulness</td>
<td>.40***</td>
<td>.35**</td>
</tr>
<tr>
<td>Team mindfulness_sq</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NGAT *</td>
<td>.042***</td>
<td>.37**</td>
</tr>
<tr>
<td>Team mindfulness_sq</td>
<td>-.12</td>
<td>-.13</td>
</tr>
<tr>
<td><strong>Mediator</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External knowledge acquired</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$F$</td>
<td>4.19*</td>
<td>10.50***</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>.117</td>
<td>.330</td>
</tr>
</tbody>
</table>

**Note:** N=76; * p<0.05; ** p<0.01; *** p<0.001.

Model 2 in Table 3 shows that the relationship between NGAT and team innovative performance is not significant ($\beta=-0.12, \text{n.s.}$), empirically verifying the needs of examining situational factors. Model 5 in Table 3 showed that team mindfulness significantly and nonlinearly moderates the relationship between the NGAT and external knowledge acquisition.
acquisition ($\beta=-0.23$, $p<0.01$), providing support for H1. To further evaluate H1, we adopted the method of Aiken et al. (1991) to conduct the simple slope test as shown in Figure 2.

![Simple slope test for the moderation effect of team mindfulness on the relationship between NGAT and external knowledge acquisition](image)

Figure 2 shows that when team mindfulness is medium, the relationship between NGAT and external knowledge acquisition is significantly positive ($b=0.31$, $t=3.66$); when team mindfulness is low (-1SD) or high (+1SD), the relationship between NGAT and external knowledge acquisition is not significant ($b=-0.09$, $t=-0.62$; $b=-0.15$, $t=-1.18$). The simple slope test provided further support for H1. Model 4 in Table 3 shows that external knowledge acquisition and team innovative performance is positive ($\beta=0.43$, $p<0.001$), supporting H2. Finally, we tested the mediated moderation hypothesis following the procedure of Preacher et al. (2007). The results are shown in Table 4.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Values</th>
<th>Effect size</th>
<th>Boot SE</th>
<th>95% BootLLCI</th>
<th>95% BootULCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Mindfulness</td>
<td>-1SD(3.91)</td>
<td>.13</td>
<td>.17</td>
<td>-.07</td>
<td>.38</td>
</tr>
<tr>
<td></td>
<td>Mean(4.83)</td>
<td>.32</td>
<td>.09</td>
<td>.08</td>
<td>.61</td>
</tr>
<tr>
<td></td>
<td>+1SD(5.75)</td>
<td>.05</td>
<td>.02</td>
<td>-.22</td>
<td>0.19</td>
</tr>
</tbody>
</table>

Results in Table 4 show that when team mindfulness is medium, the indirect effect of
external knowledge acquisition in the relationship between NGAT and team innovative performance is positive ($b = .32$, 95% CI [.08, .61]), and when team mindfulness is low (-1SD) or high (+1SD), the indirect effect of external knowledge acquisition in the relationship between NGAT and team innovative performance is not significant ($b = .13$, 95% CI [-.07, .38] and $b = .05$, 95% CI [-.22, .19]) as the 95%CI contains zero.

**DISCUSSION**

**Findings**

Based on the fact that teams inevitably and diffusively experience negative affects, scholars have advocated to understand the effect of group affective tone on team creativity and innovation (Barsade and Knight, 2015; Chi and Lam, 2022). Joining this stream of literature, this study aims to investigate how NGAT influences team innovation and when NGAT can benefit team innovation. Specifically, we built a research model that explains how team mindfulness can help to bring out the beneficial effect of NGAT on team innovative performance through the mechanism of external knowledge acquisition. Three hypotheses were proposed and tested with empirical data collected from 76 R&D teams. The results showed that 1) team mindfulness curvilinearly moderated the relationship between NGAT and team external knowledge acquisition, 2) team external knowledge acquisition was positively related to team innovation, and 3) team external knowledge acquisition mediated the interactive effect of NGAT and team mindfulness on team innovation. We discuss the theoretical and practical implications of the findings below.

**Theoretical Contributions**

First and foremost, this study answers the call to clarify the complex effect of NGAT on
team innovative outcomes (Barsade and Knight, 2015; Chi and Lam, 2022). Previous literature has not reached consensus regarding the relationship between NGAT and team innovation, with positive (George and King, 2007), negative (Rhee, 2007; Shin, 2014) and insignificant findings (Grawitch et al., 2003). Thus, in a recent work, Chi and Lam (2022) has advocated to adopt a more contingent view pertaining to the effect of NGAT on team innovation. We contributed to this contingent view by showing that whether NGAT can inhibit or promote team innovation depends on the level of team mindfulness. On one hand, NGAT can be beneficial for team innovation for team with medium level of team mindfulness. In this situation, team mindfulness help teams to decouple their emotions from their cognition and thus team members can focus more on how to solve the problems that are indicated by NGAT. On the other hand, when team mindfulness is low, team members are more likely to be trapped in the negative emotions, leading to threat-rigidity interactions that impair team innovation (Rhee, 2007). It is noteworthy that when team mindfulness is extremely high, team members will accept the status quo and thus team motivation to change and innovate will be harmed (Hafenbrack and Vohs, 2018). Taken together, team mindfulness is an important contingency in the relationship between NGAT and team innovation. It should be noted that although NGAT has potential benefits for team innovation, we are not suggesting teams to experience more negative affects, rather we try to focus on how to utilize NGAT better towards facilitating team innovation as NGAT is an inevitable part of organization life.

Second, we revealed that external knowledge acquisition is an important mechanism that transmits the interactive effect of NGAT and team mindfulness on team innovation. Two
previous studies have attempted to identify the mediators in the relationship between NGAT and team innovation from the internal perspective of the team. In an earlier work, Shin (2014) found that both team reflexivity and team promotion focus were unable to account for the relationship between NGAT and team creativity. In a more recent work, Chi and Lam (2022) found that team internal information exchange can explain the positive effect of NGAT on team creativity when the team is learning oriented. The current study thus complements prior findings from the external perspective by examining the mechanic role of external knowledge acquisition in the relationship between NGAT and team innovation. When team mindfulness is at the medium level, team members are more likely to interpret NGAT as conveying information that the situation is problematic and thus search and process information from the environment to make adaptations.

Finally, we also contributed to the literature on mindfulness. Although previous literature has found generally positive effects of mindfulness on employee welling-being and performance (Good et al., 2016; Kay and Skarlicki, 2020), scholars have argued that the effect of mindfulness on creativity and innovation is ambiguous (Good et al., 2016; Hafenbrack and Vohs, 2018). This ambiguity comes from the inherent contradiction between mindfulness and innovation, that is while mindfulness emphasizes being content with the present, innovation begins with the desire to change the status quo. Our findings thus contributed to the discussion on how mindfulness affects team innovation by suggesting that moderate level of team mindfulness is helpful in bringing out the beneficial effect of NGAT on team innovation, while low or extremely high level of team mindfulness is harmful.
**Practical Implications**

In organizations, what managers usually do is to eliminate negative affect and encourage positive affect experience for desirable organizational outcomes. The basic assumption is that positive affect is preferable over negative affect. Our findings, however, suggest that naturally happening NGAT is not simply a disaster that should be avoided, instead, NGAT may bring desirable outcomes (e.g., team innovation) for organizations. Thus, as an inevitable experience in organizational life, managers should change their faith from minimizing the negative affect experience as much as possible to utilizing those negative experiences. When the team encountered negative affect due to difficulties or even failure in R & D processes, team leaders or managers can consider it as a chance to identify potential problems and then innovatively figure out ways to solve them.

However, the potential benefits of NGAT benefits can only achieve under certain conditions. As our research shows that when the team is moderately mindful, NGAT would benefit team creativity. Thus, when experiencing negative affects, managers could use mindfulness technique such as meditation to induce the positive effect of NGAT. In addition, when the team is experiencing NGAT, team leaders can also encourage team members to acquire more information and knowledge externally, based on which team members can make adaptations for innovative solutions.

**Limitations and Future Directions**

Generally speaking, the research has achieved the expected objective and obtained some interesting conclusions. However, it should be noted that there are some limitations. In noting limitations of this paper, some directions for future research are also pointed out. First, our
data is cross-sectional, thus we could not confirm the causal effect of group affective tone on team creativity. It may be also the case that performing different levels of team creativity would engender group affective tone with different valences as the affect-creativity cycle proposed by Amabile et al. (2005). Most mood researchers, however, have theorized that creative actions should be products of group states, including affective mood states, and group processes and the group context (Ford, 1996; George and Zhou, 2002; George and Zhou, 2007). In addition, the impact of group affective tone may have incubation effect on team innovation as mood at the individual level (Amabile et al., 2005). Thus, we framed the affect experience time “during last week to now”. However, there may be some bias in retrospective survey. Thus, more rigorous research design (e.g. laboratory experiments) would provide a more validate evidence.

The second concern comes from the sample. The sample is from R & D teams in Chinese context. Although the sample met the present research requirement, we should note the peculiarities of these teams. R & D work has a high requirement for creativity and innovation. Thus, whether the result could be extended into other industries still needs further study. Third, the data is collected from a high power distance culture (Hofstede, 1984). In China, teams have to accomplish the tasks assigned to them whether difficult or not and have little room for negotiating with leaders, while this probably is not the case in low distance cultures because teams members would have the third choice to quit the task besides showing high or low level of creativity. Future research can replicate the research by introducing a longitudinal design and from different cultures when measuring team innovation, as well as further explore whether PGAT and NGAT would both facilitate team outcomes under certain
Workteams inevitably experience various negative affects when performing innovative tasks. The present study suggested that negative affect in teams would not necessarily cause negative outcomes. When the team is equipped with medium level of mindfulness, negative affect is positively related to team innovation through enhanced external knowledge acquisition. In addition to contributing to address the importance of affect and emotions in organizational behavior, the study joined the debate on the effect of negative affect in teams. We hope more research would not turn pale at the mention of negative affect and learn how to utilize group affective tone towards desirable outcomes.
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