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Original article

Communication and employee creativity in virtual teams: The mediating roles of intrinsic motivation and creative self-efficacy

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Abstract:
Based on the interactionist model of organizational creativity, the current study tests whether communication, as a contextual factor, plays a significant role in indicating employee creativity in virtual teams. Furthermore, the intent of our research was to scrutinize the mediating roles of two individual factors (specifically, creative self-efficacy and intrinsic motivation) play between communication and employee creativity. Data was collected from a sample of 267 employees who worked in virtual teams of enterprises in China and abroad. Structural equation model illustrated a multiple mediation model: the independently partial mediating path of creative self-efficacy and the chain mediating path of intrinsic motivation and creative self-efficacy. We deliberated on how these results might affect both the conceptual framework and the practical application within the context of virtual teams.

1. Introduction

Virtual team consists of employees working cooperatively towards shared purposes through information and communication technologies across space, time, and relationships (Aissa et al., 2022). In recent years, as COVID-19 sweeps worldwide, many employees have been encouraged to work remotely in virtual teams due to the current situation and policy (Pandey & Pal, 2020). As the trend of team virtualization becomes more noticeable (Blanchard, 2021), researchers focused more on the study of virtual teams, among which the improvement of employee creativity is one hot topic (Hahm, 2017; Aissa et al., 2022).

Employee creativity is the capacity of an employee to produce ideas that are both original and of value, and it is considered a core competence in the contemporary knowledge-based economic era (Aissa et al., 2022). Considering the significance of employee creativity in the development and prosperity of an organization, numerous researches have clarified its antecedents (e.g., Shaheen et al., 2020; Hora et al., 2021). However, much of the accumulated evidence has focused on the creativity in traditional and physical teams. Researchers have not yet agreed on the influencing mechanism of creativity in virtual teams.

The interactionist model of organizational creativity, proposed by Woodman et al. (1993), has been accepted in the field. They emphasized the importance of examining employee creativity in the complex social systems of organizations, suggesting that a comprehensive understanding of employee creativity requires an integrated perspective considering both individual and contextual factors. Therefore, the current study, based on the interactionist model of organizational creativity, not only investigates two of the most investigated individual

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characteristics in research of employee creativity, intrinsic motivation, and creative self-efficacy but also considers communication as a vital contextual variable to illustrate a comprehensive picture of employee creativity building in virtual teams.

1.1 Communication and employee creativity

According to Woodman et al. (1993), communication within an organizational system is crucial for the creative process. With the virtualization of teams, effective communication and information sharing among members becomes increasingly important (Hahm, 2017). Although no researchers have employed communication as an exploratory variable to discuss its impact on employee creativity, several researches on virtual teams have explored the significance of knowledge sharing for employee creativity (Hahm, 2017; Aissa et al., 2022). Hahm (2017) discussed that virtual teams are lacking in cohesiveness, and for this reason, team members in one virtual team are supposed to be active in information sharing, and in this way to improve creativity. Kauffmann & Carmi (2018) demonstrated that communication and knowledge sharing positively and significantly correlate in virtual settings. It was proposed that communication plays a significant role in elevating a team's knowledge specialization (Aissa et al., 2022), which is essential for more effective information renewal and knowledge flows, and the final production of creative outcomes (Kraus et al., 2010). We therefore hypothesize the following:

Hypothesis 1. Effective communication among members could positively predict employee creativity in virtual teams.

1.2 Mediating role of creative self-efficacy

Creative self-efficacy refers to an individual's belief about grasping the knowledge and skills to implement creative work and their abilities to succeed in their jobs (Tierney & Farmer's, 2002). When one believes that he/she can fulfill tasks with excellent creativity, it reflects his/her high level of creative self-efficacy (Tierney & Farmer's, 2002). Communication within the team typically involves brainstorming work tasks and new ideas. When team members talk about their work, creative thoughts are easily prompted (Paulus & Nijstad, 2003). Therefore, communication can help foster an atmosphere where employees continuously generate new ideas and exercise creativity. Consequently, in teams with a stronger communication culture, employees tend to be more confident in their creativity, which means more communication results in higher creative self-efficacy.

Numerous researchers have found that creative self-efficacy was positively connected to employee creativity. For instance, Farmer & Tierney (2017) pointed out a strong relationship between creative self-efficacy and self-reported and other-reported creative performance. Empirical research has elucidated that employees with high creative self-efficacy are full of curiosity and have a more adventurous spirit. They actively search for new challenges and are not afraid of risks and threats to be more conducive to creativity (Gong et al., 2020).

Evidence has been well-established about the mediating effect of creative self-efficacy on creativity in physical teams (e.g., Liu et al., 2016; Farmer & Tierney, 2017). A meta-analysis of 191 studies by Liu et al. (2016) found that creative self-efficacy is a significant mediator in the relationship between several antecedents (job autonomy, openness to experience, job complexity, conscientiousness, and supportive leadership) and creativity. The results of one study indicated that creative self-efficacy acted as an intermediary in the link between knowledge sharing and employee innovation (Hu & Zhao, 2016). It remains unknown whether employees' creative self-efficacy plays the same role in the relationship between communication and employee creativity in virtual teams. Based on the findings of physical teams, we proposed the following hypothesis:

Hypothesis 2. Creative self-efficacy mediates the relationship between communication and employee creativity in virtual teams.

1.3 Mediating role of intrinsic motivation

Like creative self-efficacy, intrinsic motivation is another variable that has been most investigated in the field of employee creativity in physical teams (e.g., Wang et al., 2016; Hur et al., 2018). Intrinsic motivation in a job refers to the motivation of employees to complete their work and the tasks that are attractive, challenging, and satisfying (Deci & Ryan, 1987). It is an important factor that encourages employees' creativity (Wang et al., 2016).

The meta-analysis by Liu et al. (2016) elucidated that intrinsic motivation was a mediator between variables (e.g., job autonomy, openness to experience) and employee creativity. Also, intrinsic motivation is considered to be a mediator in the relationship between transformational leadership and employee creativity (Wang et al., 2016). Grant & Berry (2011) illustrated in their study that employees with high intrinsic motivation in their work always held high creativity, for they tended to be encouraged to absorb more information and complete their tasks more effectively and creatively.

Numerous researchers have clarified that communication among employees positively predicts their motivation at work. One systematic review by Rajhans (2012) illustrated that communication within an organization had a lasting effect on employees' motivation. Specifically, for physical teams, effective communication among employees would boost their motivation in the workplace. Similar to creative self-efficacy, no researchers have explored the role of intrinsic motivation between knowledge sharing and employee creativity in virtual teams. Therefore, we advance the following hypothesis based on the findings on physical teams:

Hypothesis 3. Intrinsic motivation mediates the relationship between communication and employee creativity in virtual teams.

1.4 Chain mediating roles of intrinsic motivation and creative self-efficacy

Given both intrinsic motivation and creative self-efficacy can mediate the effect of communication on employee creativity, it is reasonable for further efforts to figure out whether there is a correlation between intrinsic motivation and creative

self-efficacy and how they cooperate to improve employees' creativity. It has been illustrated that intrinsic motivation and creative self-efficacy are significantly and positively correlated with each other in employees from enterprises (Kong et al., 2019). An empirical study on students in the Artistic and Performance domains suggested that intrinsic motivation affects creativity by influencing creative self-efficacy (Klatt, 2017). Drawing from the preceding discussion, we posit that intrinsic motivation serves as an intermediary, channeling the impact of communication on employee creativity through its influence on creative self-efficacy.

Hypothesis 4. Communication can indirectly predict employee creativity through the chain mediating effect of intrinsic motivation and creative self-efficacy in virtual teams.

1.5 The present study

Based on the interactionist model of organizational creativity, this study investigates the relationship between communication and employee creativity in virtual teams. Furthermore, we attempt to illustrate the underlying mediating mechanism. Fig. 1 illustrates our research model.

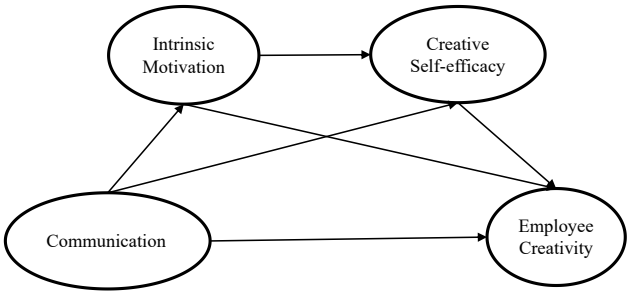

Fig. 1. The hypothesis model of relationship between communication and employee creativity.

2. Method

2.1 Participants

Two hundred and sixty-seven working staff from various categories of positions and enterprises participated in the study. Only employees who claimed to work in virtual teams were enrolled in our survey. To further verify the virtual attributes of their working teams, we asked the participants to list the percentage of the time they spent on face-to-face communication and on communication via information and communication technologies with other team members. We encoded the frequency ranging from 0-19% as rarely, 20%-39% as seldom, 40%-59% sometimes, 60%-79% as often, and 80%-100% very often. We classified the participants who often or very often communicate with communication technologies as virtual team members (Breuer, 2020). According to this operationalization, those who spent more than 40% of their time on face-to-face communication were excluded, and data from 267 participants were included in the final analysis.

Participants were all full-time employees from different enterprises located in China (86.5%) and other countries (13.5%), and all of them are Chinese. Of all the respondents, 57.3% were female. All of our participants were above the age of 18, with 6.4% of them between 18 and 25, 12.4% between 26 and 30, 50.9% between 31 and 40, 27.3% between 41 and 50, and the rest 3% above 51 years old. 65.5% of the participants had more than 10 years of working experience. Participants were all well-educated, with 85.0% of them holding a bachelor's degree or above. The respondents held various positions, including technical, assistant, managerial, marketing, etc. Most (78.2%) of our participants worked in enterprises of more than 100 employees, among which 8.6% of them in companies with 101 to 200 employees, 10.9% with 200-500 employees, 10.5% with 501 to 1000 employees, and the rest 48.3% with more than 1000 employees. This study was approved by the scientific ethical committee of the authors' university. All participants signed the informed consent form before taking the survey.

2.2 Measures

Employee creativity. Zhou & George (2001) assessed creativity using 13 items from the scale (e.g., "I come up with new and practical ideas to improve performance."). Items were answered on a 5-point Likert-type scale (1 = strongly disagree to 5 = strongly agree). The scale's internal consistency is 0.92 in this research.

Communication. Communication was assessed using six items from the scale by Campion et al. (1993) (e.g., "Teams enhance the communication among people working on the same product."). This scale was initially used to test communication in physical teams. However, it is also suitable for virtual settings because it measures universal aspects of team interactions like active communication and information sharing. These are critical in establishing effective communication and cooperation in any team environment, whether co-located or online. Items were answered on a 5-point Likert-type scale (1 = strongly disagree to 5 = strongly agree). The internal consistency of the scale is 0.86 in this research.

Creative self−efficacy. Four items from Tierney & Farmer's (2002) scale (e.g., "I have confidence in my ability to solve problems creatively ") assessed creative self-efficacy. Items were answered on a 5-point Likert-type scale (1 = strongly disagree to 5 = strongly agree). The scale's internal consistency is 0.91 in this research.

Intrinsic motivation. Intrinsic motivation was assessed using four items from Grant's (2008) scale (e.g., "I go to work every day because I enjoy it."). Items were answered on a 4-point Likert-type scale. The scale's internal consistency is 0.92 in this research.

2.3 Procedure

We released our questionnaire onto the Sojump platform (one of the biggest online questionnaire platforms with the largest number of users in China) and distributed the questionnaire through WeChat (the biggest social platform in China) for participants in China and E-mail for participants abroad. Questionnaires were distributed mainly between September 2019 and October 2019.

In the questionnaires, participants were requested for their

Table 1. Mean, Standard Deviations, and Pearson Correlation Coefficients (N = 267).

	M	SD	1	2	3	4
1 Employee creativity	3.84	0.56	-	-	-	-
2 Communication	4.19	0.74	0.48***	-	-	-
3 Intrinsic motivation	3.07	0.69	0.48***	0.44***	-	-
4 Creative self-efficacy	3.84	0.72	0.70***	0.45***	0.51***	-

Table 2. Mean, Standard Deviations, and Pearson Correlation Coefficients (N = 267).

	χ^2	df	χ^2/df	CFI	GFI	AGFI	RMSEA
Model 1	97.45	48	2.03	0.98	0.95	0.91	0.06
Model 2	101.39	49	2.07	0.98	0.94	0.91	0.06
Model 3	88.30	48	1.84	0.99	0.95	0.92	0.06

demographics (i.e., gender, age, educational background, job category, work site, and job tenure), their perceptions of communication within organizations, their creative self-efficacy, intrinsic motivation, and creativity in their work. When we collected the questionnaire, to make sure all the answers were based on the virtual team settings, we made it clear to the participants in the prompts that "The questions you answered are all set in the context of virtual teams, that is, you need to consider your actual situation in the following aspects when you communicate with your team members remotely." In the data collection process, 31 surveys were eliminated for early submission (less than 5 minutes) or single options.

2.4 Analytical strategy

We assessed the reliability using Cronbach's alpha, and conducted descriptive statistical analysis, including mean and standard deviation, as well as Pearson correlations using SPSS Version 26. For our analysis, a Cronbach's alpha value of 0.70 or above was considered adequate (Nunnally & Bernstein, 1994). Confirmatory factor analyses (CFA) and multivariate analyses employing structural equation modeling (SEM) were carried out in AMOS Version 24, applying maximum likelihood estimation techniques. We opted for this method due to its ability to manage measurement errors and its effectiveness in using multiple indicators, as advocated by Kline (2011). In the CFA process, we looked for factor loadings to meet a minimum threshold of 0.50, but ideally to exceed 0.70, following the guidelines set by (Hair et al., 2014). We parceled items into three dimensions with random assignment (Little et al., 2002) to control measurement errors caused by having quantities of items for each latent variable (Zhao et al., 2012). By parceling, we aimed to enhance measurement reliability by mitigating the impact of measurement error. This approach contributes to the stability and consistency of the scales' measurement (Marsh et al., 2014) and improves measurement quality and analysis efficiency. To estimate the global fit of the models, we used the χ^2 value, as well as four alternative measures: the root-mean-square error of approximation (RMSEA), the goodness of fit index (GFI), the adjusted goodness-of-fit index (AGFI), and the comparative fit index (CFI). RMSEA values less than or equal to 0.08 (Browne & Cudeck, 1992) indicate an acceptable fit between the proposed model and the data. GFI, AGFI, and CFI values up to or higher than 0.90 (Hu & Bentler, 1999) indicate a good fit.

3. Results

Table 1 shows descriptive statistics and correlation analysis results. As illustrated, employee creativity, communication, intrinsic motivation, and creative self-efficacy were significantly and positively related to each other.

We developed the latent constructs of employee creativity, communication, intrinsic motivation, and creative self-efficacy from a variety of observed items. The confirmatory factor analyses indicated that these constructs were well-formed, with all indicators demonstrating statistically significant factor loadingss ($p < 0.01$ or $p < 0.05$). These factor loadings surpassed the minimum quality threshold of 0.50 as suggested by Hair et al. (2014). Furthermore, the majority of the factor loadings approached or exceeded the value of 0.7, signifying that the constructs were of notably high quality.

As is shown in Table 2, the hypothesized model (Model 1) in Fig. 1 offered an acceptable fit to data: $\chi^2(48) = 97.45$, $\chi^2/\text{df} = 2.03$, $p < 0.001$, CFI = 0.98, GFI = 0.95, AGFI = 0.91, RMSEA = 0.06. However, the path from intrinsic motivation to employee creativity was nonsignificant (b = 0.12, 95% bootstrap CI [-0.01, 0.25], p = 0.05). Therefore, we further tested a new model without the nonsignificant path (Model 2). The mediation model in Fig. 2 (Model 2) also showed a good fit to the data as well: $\chi^2(49) = 101.39$, $\chi^2/df = 2.07$, $p < 0.001$, CFI = 0.98, GFI = 0.94, AGFI = 0.91, RMSEA = 0.06. To ascertain the significance of discrepancies between Model 1 and Model 2, we conducted a Chi-square difference ($\Delta\chi^2$) test, using Model 1 as the reference point (Bentler & Bonett, 1980; Bollen, 1989). This yielded a $\Delta\chi^2$ of -3.94 (Model 1: $\chi^2 = 97.45$, Model 2: $\chi^2 = 101.39$), and a degrees of freedom difference (Δdf) of -1 (Model 1: $df = 48$, Model 2: $df = 49$). And the difference between Model 1 and

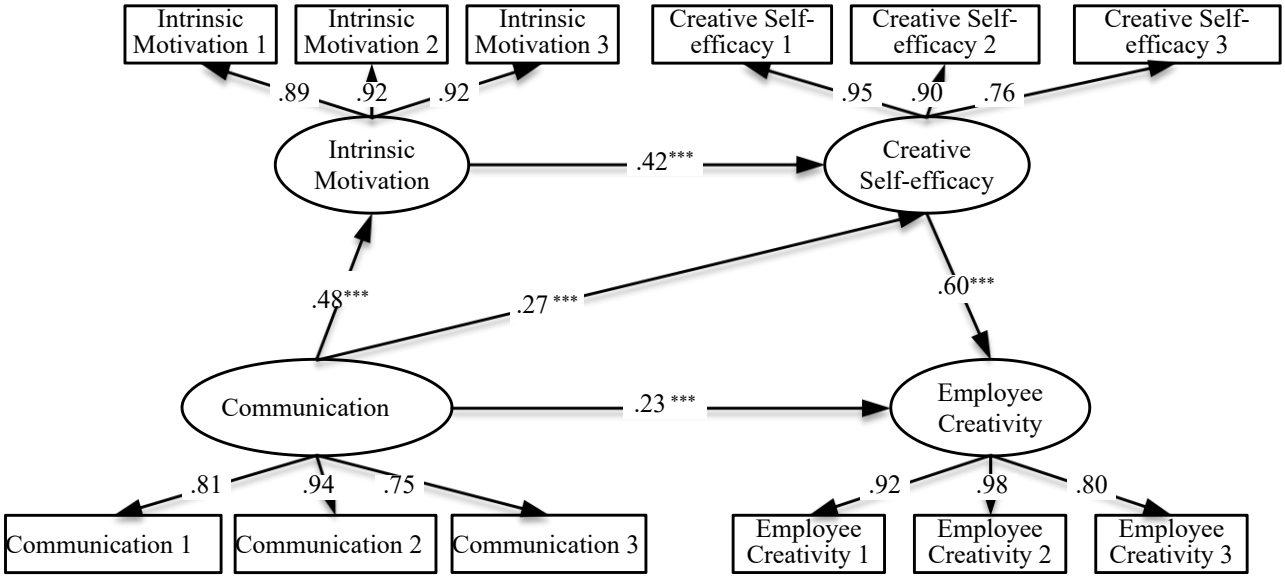

Fig. 2. Mediation model with standard path coefficient (***$p < 0.001$).

Model 2 is not significant ($p = 0.95$). We therefore selected the simpler model (Model 2) in Fig. 2 (Kline, 2015).

To test the possibility of common method bias, based on Model 2, the common method bias is added to build the common method model (Model 3) (Williams & McGonagle, 2016). Results showed that model 3 fitted well ($\chi^2(48) = 88.30$, $\chi^2/df = 1.84$, $p < 0.001$, CFI = 0.99, GFI = 0.95, AGFI = 0.92, RMSEA = 0.06). However, compared with model 2, the variation of the indexes (CFI, GFI, AGFI, and RMSEA) were all smaller than 0.02, indicating that the model did not improve significantly. Therefore, common method variance was not a serious problem in our research.

We evaluated the mediating roles of intrinsic motivation and creative self-efficacy by using both symmetric and 95% bias-corrected bootstrap confidence intervals for our path analysis ($N = 5000$; Hayes, 2017). The direct, indirect, and total effects, along with their 95% confidence intervals, are detailed in Table 3. We found that communication exerted a significant and positive indirect influence on employee creativity through creative self-efficacy. Additionally, there was a sequential indirect effect on employee creativity, mediated first by intrinsic motivation and then by creative self-efficacy. Moreover, the direct impact of communication on employee creativity was both positive and statistically significant.

4. Discussion

The current study investigates the relationship between communication and employee creativity and the possible mediating effects of intrinsic motivation and creative self-efficacy in virtual teams. Consistent with the interactionist model of organizational creativity (Woodman et al., 1993) and the previous finding (Hahm, 2017), communication, as a context variable, could positively and significantly predict employee creativity. Furthermore, in virtual teams, the relationship between communication and employee creativity was mediated positively and significantly by intrinsic motivation and creative self-efficacy.

Our results show that effective virtual team communication could positively predict employees' creativity. Due to the innate shortages of virtual settings, members who work virtually cannot communicate with each other directly (face-to-face), which hinders the effectiveness of information exchange and collaboration within organizations (Yue et al., 2019). Therefore, effective and fluent communication and knowledge sharing require more emphasis in virtual teams than in physical ones. By exchanging information in correlation with work, employees in virtual team settings are exposed to a wider range of ideas, skills, and information, with which they can generate more novel ideas about their work (Kraus et al., 2010). Moreover, through transparent communication within organizations, employees would show more openness to change, motivating them to show more creativity inclinations (Yue et al., 2019). In addition, in line with the prior findings of physical teams (Farmer & Tierney, 2017; Liu et al., 2016), the mediating role of creative self-efficacy for the effect of communication on employee creativity was also found in virtual teams, suggesting that good communication among employees would predict their high creative self-efficacy for work, and then improve their creative activities. It was proposed by Hu & Zhao (2016) that employees who possessed more knowledge tended to show greater confidence when completing challenging jobs, which thus enhanced their sense of control of knowledge and flourished their self-efficacy toward formulating creative ideas (Tierney & Farmer's, 2002).

Meanwhile, the current study demonstrated that in virtual teams, intrinsic motivation and creative self-efficacy sequentially mediated the association between communication and employee creativity. One empirical research found a positive relationship between transparent communication and employee cognitive trust in virtual team settings (Kauffmann

Table 3. Direct, indirect, and total effects and 95% confidence intervals.

Indirect effect	b	95%CI	
		Lower	Upper
Communication → Creative self-efficacy → Employee creativity	0.16	0.05	0.30
Communication → Intrinsic motivation → Creative self-efficacy → Employee creativity	0.12	0.04	0.23
Direct effect			
Communication → Employee creativity	0.23	0.10	0.36
Total effect			
Communication → Employee creativity	0.51	0.34	0.74

& Carmi, 2018). Through communication with colleagues and supervisors in their daily work, employees would have the feeling of trust from the organization and experience of mastery towards their work. Furthermore, they would show more enthusiasm and intrinsic motivation for their job, which would help employees be more active in their tasks (Deci & Ryan, 1987). Also, they would be inclined to enjoy themselves when faced with difficulties, through which their intrinsic motivation and creative self-efficacy to find effective and innovative solutions for their work would be boosted (Hur et al., 2018). Therefore, when engaged in the virtual team that emphasizes making progress through creative work, employees in a more communicative environment would be more inclined to fulfill their values by making innovative breakthroughs.

However, inconsistent with prior research about physical teams (Hur et al., 2018; Shaheen et al., 2020), our study did not find the direct mediating effect of intrinsic motivation on employee creativity in virtual teams. Possible reasons are as follows. Firstly, intrinsic motivation measured in our study focused on employees' passion and motivation for their work, while previous research on creativity mainly focused on employees' motivation for creative performance (e.g., Liu et al., 2016; Kong et al., 2019). It was proposed that employees are inclined to show more enthusiasm towards their jobs when engaged in a positive communication environment (Deci & Ryan, 1987). Therefore, it is reasonable that communication contributes more directly to employees' intrinsic motivation toward their jobs (rather than that towards creative behaviors). Secondly, for employees in virtual working environments, the reinforced intrinsic motivation may enhance employees' creative behaviors only through their increased self-efficacy toward creativity. It is common sense that accumulating novel ideas and developing new products or services are tough procedures filled with challenges (Amabile & Pratt, 2016). When working in virtual settings, employees may not be able to receive instant feedback from their leaders or coworkers, which tend to be important factors for persevering in the innovation-producing processes. Hence, when validations from others are not available, high confidence in their ability to creativity is indispensable for employees to persist in the face of troubles and failures and finally succeed in creative activities (Hur et al., 2018).

The current research makes several contributions. Firstly, by introducing communication as an exploratory variable, this study is the first to explore the mediating mechanism underlying the relationship between communication and employee creativity in virtual teams, enriching the study of employees' creative processes within virtual settings. Second, our study elucidated that effective communication is conducive to employee creativity, which may shed some practical implications. For instance, administrators of virtual teams are supposed to create a more interactive environment for employees to promote the flow of knowledge resources. Although members are in different spaces, team leaders could make full use of communication technologies such as Zoom and Google Meets to boost employees' initiative in idea production (Blanchard et al., 2020) and finally pace the way for more creative outcomes (Kraus et al., 2010). Third, our research proposed that creative self-efficacy is nonnegligible for employees' creative performance in virtual team settings. By setting up effective reward systems, administrators can help employees build their confidence toward creative performance (Zhou et al., 2021). In the meantime, intrinsic motivation is also important in elevating employee creativity. By transmitting the meaning of the job and granting employees more freedom and autonomy, administrators of virtual teams can raise employees' interest in their work (Wang et al., 2016).

The study has some limitations. First, we adopted the cross-sectional design, which did not allow the observation of within-subject changes and could not provide sufficient evidence for causal inference. Future research could collect longitudinal data for further clarification. Second, this study only used the self-evaluation method, which can be biased with respect to respondents' recall (Rosenman et al., 2011). To achieve a more objective rating of employees' creativity in virtual teams, a comprehensive assessment by adding other-evaluation data (e.g., colleagues-evaluation or employers-evaluation) would be more favorable (Puryear et al., 2017). Therefore, future studies should consider the collection of other evaluation data. Third, although we tried to control the sources of our participants, all of them are from China, which constraints the generalizability of our results. Future researchers need to recruit participants from wider ranges of countries, and different organizational contexts to obtain a more generalizable conclusion. Additionally, other demographic characteristics of our participants were diverse, such

as gender, age, work site, and company size. Despite efforts to control for such variables in our analysis, inherent complexities might exist due to the broad-ranging demographic diversity. We propose that future studies could delve further into these specific aspects and adopt a stratified approach or multivariate analysis for a more granular exploration of these potential confounding factors.

In conclusion, we elucidated that in virtual teams, communication directly impacts employee creativity. Additionally, our results revealed that intrinsic motivation and creative self-efficacy mediate the relationship between communication and employee creativity in virtual team settings. To promote employees' creativity, administrators of virtual teams are supposed to take actions to foster a more interactive environment for open communication and knowledge flow with the aid of information and communication technologies and to boost employees' motivation for work as well as their self-efficacy toward creative performance.

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Conflict of interest

The authors declare no competing interest.

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