Collaboration and Performance in Virtual Teams with Faultlines: An Emotional Management Intervention

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Abstract

Problem: Virtual teams with faultlines face challenges due to their dispersion, diversity, and virtuality, which can diminish their performance. To resolve this issue, team emotional management (TEM) interventions foster teams' collaboration capability, that is, the team's ability to build and manage relationships based on trust, commitment, and communication. **Goals:** This research aimed to analyse whether a TEM intervention can enhance team performance by improving the collaboration capability in virtual teams with faultlines. **Method:** Fifty-two four-member teams participated in an experiment with repeated measures (three measurement times). Teams were randomly assigned to either a TEM intervention or a control condition. **Main results:** The TEM intervention had a positive effect on trust and commitment, but not on communication. Moreover, trust and commitment fully mediated the effect of the TEM intervention on performance. **Main implications:** Our findings showed the relevance of a TEM intervention in improving the collaboration capability and performance in virtual teams with faultlines. This study contributes to research on faultlines, affect management in virtual teams, and computer-mediated communication.

Keywords: collaboration in virtual teams, emotional management, team performance.

Colaboração e Desempenho em Equipes Virtuais com Subgrupos: Uma Intervenção de Gerenciamento Emocional

Resumo

Problema: equipes virtuais com subgrupos enfrentam desafios devido à sua dispersão, diversidade e virtualidade, o que pode diminuir seu desempenho. Para resolver esse problema, as intervenções de gerenciamento emocional da equipe (*team emotional management* - TEM) estimulam a capacidade de colaboração das equipes, ou seja, a capacidade da equipe de construir e gerenciar relacionamentos com base na confiança, compromisso e comunicação. **Objetivos:** Esta pesquisa teve como objetivo analisar se uma intervenção TEM pode melhorar o desempenho da equipe, melhorando a capacidade de colaboração em equipes virtuais com subgrupos. **Método:** 52 equipes de quatro membros participaram de um experimento com medidas repetidas (três tempos de medidas). As equipes foram aleatoriamente designadas para uma intervenção TEM ou uma condição de controle. **Principais resultados:** A intervenção TEM teve um efeito positivo na confiança e no compromisso, mas não na comunicação. Além disso, a confiança e o compromisso mediaram totalmente o efeito da intervenção TEM no desempenho. **Principais implicações:** Nossos resultados mostraram a relevância de uma intervenção TEM na melhoria da capacidade de colaboração e desempenho em equipes virtuais com subgrupos. Este estudo contribui com a pesquisa sobre subgrupos, gerenciamento de impacto em equipes virtuais e comunicação mediada por computador.
Palavras-chave: colaboração em equipes virtuais, gestão emocional, desempenho de equipe.

Colaboración y Desempeño en Equipos Virtuales con Subgrupos: Una Intervención en Gestión Emocional

Resumen

Problema: los equipos virtuales con subgrupos afrontan desafíos debido a su dispersión, diversidad y virtualidad, lo que puede disminuir su desempeño. Para resolver este problema, las intervenciones en gestión emocional en equipo (TEM) fomentan la capacidad de colaboración de los equipos, es decir, la capacidad del equipo para construir y gestionar rela-ciones basadas en la confianza, el compromiso y la comunicación. **Objetivos:** esta investigación tuvo como objetivo analizar si una intervención TEM puede mejorar el desempeño del equipo al mejorar la capacidad de colaboración en equipos virtuales con subgrupos. **Método:** Cincuenta y dos equipos de cuatro miembros participaron en un experimento con medidas repetidas (tres tiempos de medida). Los equipos fueron asignados al azar a una intervención TEM o una condición de control. **Resultados principales:** La intervención TEM tuvo un efecto positivo en la confianza y el compromiso, pero no en la comunicación. Además, la confianza y el compromiso mediaron completamente el efecto de la intervención TEM sobre el desempeño. **Implicaciones principales:** Nuestros hallazgos mostraron la relevancia de una intervención TEM para mejorar la capacidad de colaboración y el desempeño en equipos virtuales con subgrupos. Este estudio contribuye a la investigación sobre subgrupos, gestión del afecto en equipos virtuales y comunicación mediada por ordenador.

Palabras clave: colaboración en equipos virtuales, gestión emocional, desempeño de equipo.

Technological developments and greater complexity in organizations due to globalization have increased the use of virtual teams (Gilson et al., 2015; Hahn & Lee, 2017). Members of virtual teams must solve complex problems and work towards common goals through computer-mediated communication (Dulebohn & Hoch, 2017). They are geographically and/or temporally dispersed, and they usually have different cultural backgrounds (Jarvenpaa & Leidner, 1999). Thus, diversity is both a key characteristic and a potential strength of virtual teams (Han & Beyerlein, 2016). Based on the information/decision-making perspective, team members' different backgrounds produce a broad pool of knowledge, expertise, and experiences that can stimulate innovation and performance. However, the diverse characteristics of team members can also be a source of impediments to team performance (van Knippenberg & Mell, 2016), especially in virtual teams, due to the reduced availability of personal and contextual cues (Altschuller & Benbunan-Fich, 2010). The perception of similarities with some team members and differences from others could trigger negative affect and in-group/out-group biases. Consequently, participants show positive feelings and responses only to their subgroup (van Knippenberg & Mell, 2016). This phenomenon, known as diversity faultlines, occurs when two or more perceived diversity characteristics align in a team (Lau & Murnighan, 1998). Faultlines are hypothetical dividing lines that split virtual teams into subgroups, eliciting inter-subgroup bias that inhibits interpersonal dynamics (Gibbs et al., 2017), increases psychological distance among participants, and harms team collaboration processes and performance (Bjørn & Ngwenyama, 2009; Hogg & Terry, 2000; Jehn & Bezrukova, 2010).

Prior research tried to find strategies to mitigate the negative effects of faultlines (e.g. Rico et al., 2012). To do so, the role of emotions within teams is crucial (Chang et al., 2012). For example, positive emotions boost teamwork because they lead to collaborative behaviour among members due to emotion contagion (Diener et al., 2020), increasing perceived performance (Barsade, 2002). Similarly, Grandey and Melloy (2017) propose that in work contexts with high levels of interaction (e.g. virtual teams), emotion regulation becomes essential to long-term performance. The proper management of group affect (i.e., creation of shared understandings and norms for emotion regulation) could bridge diversity faultlines and increase performance in computer-mediated communication contexts. In this regard, prior research highlights the numerous benefits of emotions and emotional management in virtual teams (e.g. Mysirlaki & Paraskeva, 2020; Quisenberry, 2018). Moreover, emotional management could be a key tool to manage the consequences of the Coronavirus Disease 2019 (COVID-19) for workers (Restubog et al., 2020), and so TEM training becomes necessary. Thus, in this study we train team members to manage emotions in virtual environments. We argue that reducing psychological distance between the subgroups facilitates the development of collaborative capabilities that are necessary for team effectiveness (Bjørn & Ngwenyama, 2009). Consequently, team members will develop relational-oriented capabilities that improve their functioning, such as team collaboration capability, composed of trust, commitment, and communication (Altschuller & Benbunan-Fich, 2010; Batarseh et al., 2017; Blomqvist & Levy, 2006).

Thus, this research has a dual objective. First, we study the influence of a Team Emotional Management (TEM) intervention on team performance in virtual teams with faultlines. Second, we analyse the mediating role of Team Collaboration Capability (composed of trust, commitment, and communication) in the relationship between the TEM intervention and performance.

TEM Intervention & Team Performance in Virtual Teams

Teams' ability to competently manage emotions is essential for team effectiveness (Meng et al., 2015; Michinov & Michinov, 2020). In virtual teams, effectiveness has gained relevance as team complexity has increased (Mathieu et al., 2019). Effectiveness of teams can be studied in many ways (Mathieu et al., 2017), and it includes both direct results and team perceptions of the results and functioning of the group (García-Buades et al., 2019; Salas et al., 2005). The evaluation of effectiveness based on team members' views is relevant because the virtual environment is complex and influences performance outcomes. Thus, it is important to know how team resources have been used, the strategies applied, and the efficiency in achieving the goals (Zornoza, 2013). Thus, we define team performance as the members' perception of the way the team has obtained the outcome and its quality.

Prior research linked emotion management in groups and teams to important outcomes such as team viability, proper decision-making, satisfaction, conflict reduction, and team performance (Chang et al., 2012; Costa et al., 2015; Diener et al., 2020; Michinov & Michinov, 2020). Members' emotional states are mimicked by other members due to the group interaction, generating an "emotional spiral" among members (Ashkanasy & Dorris, 2017). Therefore, to be effective, teams need to create attitudes and behaviours that can identify and process emotions at the group level (Michinov & Michinov, 2020). Thus, team members must be aware of the emotions of other members and the group's emotions or moods and manage them collectively (Druskat & Wolff, 2001). Emotion management further facilitates effective communication, trust, and, in turn, performance in teams (Barsade & Knight, 2015; Chang et al., 2012; Diener et al., 2020; Quisenberry, 2018).

Despite this, emotion management in virtual teams has hardly been studied, due to the difficulty of detecting and measuring emotions in computer-mediated communication contexts (Derks et al., 2008; Pitts et al., 2012). According to cues filtered-out approaches (Culnan & Markus, 1987), the lack of nonverbal cues is detrimental to the development of online relationships among members (Derks et al., 2008). Thus, emotions in virtual teams are complex to manage because technology can hinder interactions among participants, and these interactions are a key trigger of emotions (Johnson et al., 2009). Contrary to this perspective, Social Information Processing (SIP) theory argues that computer-mediated communication can convey affective information and relational communication even though nonverbal cues are less available (Walther, 2015; Xu & Liao, 2019). The expression of emotions and exchange of social information about how we feel still take place, but through other means. Therefore, according to SIP theory, participants in virtual environments exchange socio-emotional information through the content, style, and timing of their verbal messages online. The main principles of the theory are: first, the interchangeability of cues, which means that team members use any available resources to adapt cues to the environment where they operate; and second, the exchange of social information and relational communication takes more time than in face-to-face interactions (Walther, 2015). Hence, team members in computer-mediated communication contexts need to be competent in using verbal resources to express and manage socio-emotional information such as paralinguistic cues and emoticons, as well as in managing time (Derks et al., 2008; Kalman et al. 2013; Skovholt et al., 2014; Walther, 2015).

In the current study, we implement a TEM intervention for virtual teams. The aim of this intervention is to develop the effective expression and regulation of emotions and affective

states of virtual team members through written interactions. Past research highlights the importance of interventions for developing team skills (Lacerenza et al., 2018) and emotional management for team results (Quisenberry, 2018). Interventions are common in virtual environments because the competences of workers in face-to-face environments do not always transfer to the virtual context. Thus, specific training programs on how to work in virtual teams have been developed. For example, Godin et al., (2017) combined technology acceptance and virtual teamwork training models to teach participants to use an online tool for teamwork. Martínez-Moreno et al. (2015) developed a training program for virtual teams based on process and result feedback that improved conflict management. However, there is a research gap in the training literature on emotion management because many previous team interventions omitted emotions or aimed to remove emotions from teams (Druskat & Wolff, 2001). Previous research viewed emotions as obstacles to team effectiveness (Kelly & Barsade, 2001). However, we argue that because TEM is inhibited by the characteristics of the team (faultlines) and the restrictions of the medium (computer-mediated communication), helping teams to manage their emotions in order to build a positive social and emotional context will foster team collaboration and strong team effectiveness.

A TEM intervention will allow teams to regulate their work emotional climate, thus improving wellbeing and performance (Jordan & Ashkanasy, 2013). Past research noted that the proper use of emotions while working in teams helps members to re-allocate team resources to focus on significant tasks (Joseph & Newman, 2010). Similarly, teams whose members know how to manage their emotions collaborate more, trust their teammates, experience less conflict, and use adequate strategies to improve team performance (Chang et al., 2012; Jordan & Troth, 2004). Field studies also show that team members who manage their emotions increase project management performance (Turner & Lloyd-Walker, 2008).

Moreover, teams with faultlines deal with an additional challenge regarding group affect (Carton & Cummings, 2012). Subgroups reduce team identification and increase conflict and negative emotions among team members (Chang et al., 2012; Jehn & Bezrukova, 2010), ultimately reducing TEM and team effectiveness (Carton & Cummings, 2012). Consequently, a TEM intervention is especially important for overcoming barriers associated with faultlines, and it will increase performance in virtual teams with faultlines. In this context, we study the effect of an intervention for promoting TEM on team performance in virtual teams with faultlines. Accordingly, we propose the following:

Hypothesis 1. The TEM intervention will increase the level of team performance in virtual teams

The Mediating Role of Team Collaboration Capability

Team-based collaboration is of primary importance in leveraging effectiveness and contributing to the success of the team (Batarseh et al., 2018; Cole et al., 2019). Moreover, the importance of the collaboration capability is accentuated under conditions of complexity and uncertainty (Blomqvist & Levy, 2006), such as in computer-mediated communication contexts (Romero et al., 2009). Thus, due to the characteristics of virtual teams with faultlines (interaction through computer-mediated communication tools, member and/or temporal dispersion, alignment of diversity characteristics), collaboration becomes essential. Collaboration capability could help to reduce the interaction breakdowns and psychological distance that can appear in virtual teams (Bjørn &

Ngwenyama, 2009). Based on a relational framework (Blomqvist & Levy, 2006), collaboration capability is built on the team members' ability to establish personal links with each other in a way that optimizes team resources (Batarseh et al., 2017).

In this way, collaboration capability involves social interaction among team members in terms of integration, compromise, and open communication (Romero et al., 2009). Collaboration capability provides a way to create shared meaning and understanding about how the team could handle interactions in a computer-mediated communication context (Bjørn & Ngwenyama, 2009). It facilitates the exchange of resources and information, producing mutual gains among team members and helping the team to achieve goals that would not be possible if attempted individually (Blomqvist & Levy, 2006; Romero et al., 2009). Moreover, collaborative capability could mitigate the negative effects of faultlines. The display of collaborative behaviours and processes could reduce identification with the subgroup and bring teammates closer to each other. Thus, to enhance the beneficial effects of diversity on virtual team outcomes, team members could develop relational-oriented collaborative capability (Batarseh et al., 2018).

Therefore, collaboration capability has been attracting considerable interest in recent computer-mediated communication and team literature (Batarseh et al., 2017, 2018). A large body of research points to different specific factors that compose collaborative capabilities (Jarvenpaa & Leidner, 1999; Morgan & Hunt, 1994). In an overview, Blomqvist and Levy (2006) identified successful collaborative skills in teams as Team Collaboration Capability (TCC), defined as the team's ability to build and manage relationships and interactions based on trust, commitment, and communication (Blomqvist & Levy, 2006). In this study, we draw on the multi-dimensionality of TCC (Blomqvist & Levy, 2006; Ulbrich et al., 2011) and conceptualize it as three relational variables (trust, commitment, and communication) that would influence the management of relationship quality among members and benefit performance (Blomqvist & Levy, 2006).

First, team *trust* is the level of confidence among team members (Haines, 2014; Pinjani & Palvia, 2013). Trust is essential in virtual teams with faultlines because virtual environments are perceived as particularly ambiguous and uncertain, and faultlines promote social competition within the team (Jehn & Bezrukova, 2010). However, trust reduces these perceptions. It makes members more prone to risk-taking behaviours that facilitate interpersonal interaction, such as sharing information, confronting inadequate decisions, or mutual feedback. Trust makes team members vulnerable to other members on the basis that their behaviours will benefit the team (Breuer et al., 2016). This, in turn, facilitates coordination of personal resources and improves performance (Alsharo et al., 2017). In brief, it is a critical factor in virtual teams' success and effective collaboration (Breuer et al., 2016; Breuer et al., 2020).

Second, we define team *commitment* as an affective bond that compels team members to take a relevant course of action (Batarseh et al., 2017). Commitment shows a strong, positive correlation with team performance (Meyer & Herscovitch, 2002). Members of virtual teams with high commitment will experience higher group belonging and caring for the team, encouraging other members to become involved in common goals (Haines, 2014) despite the presence of faultlines.

Finally, team *communication* is a relational factor that is essential to performance in virtual teams (Altschuller & Benbunan-Fich, 2010; Marlow et al., 2018). Communication promotes collaborative processes by helping to coordinate collective effort and facilitating knowledge flow. It is also the way to obtain information about members' visibility and their ability to achieve goals, engage, and

support the team (Lester et al., 2002). Therefore, communication smooths interactions and facilitates relationship building and the creation of a supportive climate, which makes it necessary for performance.

In sum, the three factors that encompass TCC will benefit performance. However, it is not clear how TCC can be promoted in virtual teams. Past research found that emotion management is a strategy to support collaborative capabilities in face-to-face and virtual teams (Cole et al., 2019). Team members who know how to express their emotions during virtual interactions help group-based positive moods and emotions to appear that affect specific collaborative capabilities and increase performance. Kerr et al. (2006) suggested that interpersonal processes characterized by open communication and a sense of trust are created through the adequate management of emotions (Kerr et al., 2006). Additionally, the appearance of positive emotions and a proper team climate has been related to commitment in teams (Kelly & Barsade, 2001).

In conclusion, the extant research highlights the positive effect of emotion management on collaboration and team effectiveness (Jordan & Ashkanasy, 2013; Romero et al., 2009). Following this rationale, we implement an intervention to enhance team competences to better express, recognize, and manage emotions at the group level and develop a positive climate in computer-mediated communication environments. We argue that it will improve TCC (trust, commitment, and communication), which in turn will increase team performance. Therefore, we propose the following:

Hypothesis 2. Team Collaboration Capability (Trust (H2a), commitment (2b), communication (2c)) will mediate the effect of a TEM intervention on team performance.

Method

Participants

The sample consisted of 52 virtual teams with 4 members each (208 participants). Participants were bachelor-level students from Spain enrolled in organizational behaviour courses. The sample was composed of 30.8% men ($N = 64$) and 69.2% women ($N = 144$). The mean age was 20.9 years ($SD = 5.3$). We recruited the sample by introducing participation in the experiment as an innovative approach to the course contents that would improve their skills in working in computer-mediated communication contexts. Membership was stable during the experimental period, and participants were not allowed to contact their teammates outside the experimental sessions.

Design. We conducted a randomized pre-post design with a control group: we had a 2 x 3 design (2 between-subject: TEM intervention or control condition; and 3 within-subject: pre-intervention session (time 1) and 1st and 2nd post-intervention sessions (times 2 and 3)). Virtual teams were randomly assigned to either the experimental or the control condition. However, the university of origin was used to create the faultline, and so we balanced the participants on the teams so that two members came from one university and two came from the other.

Instruments

Team trust. We used an adapted version of the trust in peers scale by Haines (2014). The scale was composed of five items rated on a six-point Likert-type scale. The possible answers ranged from one *(strongly disagree)* to six *(strongly agree)*. An example item is "I can rely on my other group members to achieve what

is expected of them". The Cronbach alpha for this scale was .96.

We measured this variable at the individual level asking for the individual perceptions, but participants worked in virtual teams. Therefore, we aggregated individual responses at the team level following a direct consensus model (Chan, 1998). We checked the adequacy of this process by calculating different indexes that support aggregation at the time points under study. In this case, we used team trust measured at time 2. First, $r_{wg(j)}$ was calculated to assess within-group agreement (James et al., 1984). The value of $r_{wg(j)}$ was .87 ($SD = .24$), which is above the accepted threshold of .70 (O'Neill, 2017). To further support aggregation, we calculated the AD Index, which also evaluates interrater agreement (Burke & Dunlap, 2002) for the main variables of the study. The value was .80 ($SD = .35$), which is below the cut-off point of .83 for this scale, based on the number of response options (Burke & Dunlap, 2002). We also calculated the intraclass correlation 1, ICC(1), which represents the proportion of total variance that can be explained by group membership (Bliese, 2000). ICC(1) was .08. According to different authors, values above .05 meet the established cut-off point to aggregate values (Bliese, 2000).

Team commitment. This variable was measured by four items used in Batarseh et al., (2017). The items were measured on a six-point Likert scale ranging from one *(strongly disagree)* to six *(strongly agree)*. An example item is "Team members feel as if the team's problems are their own". We used this variable measured at time 2. The Cronbach alpha was .94. This variable was also aggregated using a referent-shift consensus model (Chan, 1998), so that the items used the team as referent for the questions. The data aggregation results were .71 ($SD = .32$) for $r_{wg(j)}$. The AD index was .52 ($SD = .37$), which is below the cut-off point of .66 for this scale. ICC(1) was .08.

Team communication. This variable was measured by eight items used by Lester et al., (2002). The items were measured on a six-point Likert scale ranging from one (*strongly disagree*) to six (*strongly agree*). An example item is "the members of my team are very willing to share information with other team members about our work". We used this variable measured at time 2. Results of the reliability test indicated good reliability, with a Cronbach's alpha of .95. Regarding data aggregation results based on a referent-shift consensus model, for $r_{wg(j)}$ the value was .94 ($SD = .14$). AD index was .48 ($SD = .25$), which is below the cut-off point of 1.3 for this scale. ICC(1) was .17.

Team performance. This scale was adapted from the EADG-II scale (Dimas et al., 2016). It evaluates performance of teams that work on non-routine tasks (i.e. tasks that involve few standardized processes, with unforeseeable results, or that require solving complex or ambiguous problems). The scale was composed of eight items rated on a ten-point Likert scale ranging from one *(bad)* to ten *(excellent)*. An example item is to rate the "quality of the work produced". In this case, we used team performance measured at times 2 and 3 to test Hypothesis 1 and also aggregated it to the team level using a referent-shift consensus model. Cronbach's alpha was .96 for time 2 and time 3. This scale was also aggregated at the team level. $r_{wg(j)}$ was .91 ($SD = .19$) for time 2 and .92 ($SD = .17$) for time 3. The AD indices were .92 (SD: .43) for Time 2 and .8615 (SD: .4438) for Time 3, which are below the cut-off point of 1.3 for this scale. Regarding ICC(1), it was .13 and .18 for times 2 and 3, respectively.

Considering the aggregation indexes together, we decided to further aggregate all the scales to the team level (Bliese, 2000).

Data Collection Procedures and Ethical Considerations

All the participants were geographically distributed; thus,

the experiment was conducted in an online environment designed *ex profeso* for this research. It was an interactive and synchronous computer-mediated communication platform. It allowed instructions for participants to be displayed, as well as video broadcasts and the use of questionnaires and interactive documents by team members. It also included a live chat with emoticons. Teams had to meet on a weekly basis to participate in the sessions (one-week time lag between sessions, either experimental or intervention sessions). They did three experimental sessions and two TEM intervention sessions. We performed a pilot study to test the time required during each session to solve the tasks and activities on the computer-mediated communication platform. All the teams performed the same tasks and activities. However, the order was modified so that the experimental condition received the TEM intervention after the first session. Teams in the control condition were a wait-list control group, and so measures were taken after each experimental session, and then this group received the intervention for ethical reasons.

Participation was voluntary and proposed to fulfil part of the course requirements, and participants received course credit for it. We held an informative meeting where all the participants signed a participation form approved by the ethics committee of the University. In this session, we also taught participants how to use the computer-mediated communication platform.

During the experimental sessions at times 1, 2 and 3, participants performed three "survival" tasks integrated with digital storytelling. These types of activities are considered intellective decision-making tasks, based on McGrath's (1984) circumplex model of group tasks. They have been used in experimental and applied contexts with teams (e.g., Chiu & Staples, 2013; Jordan & Troth, 2004). The Survival situations are presented first individually and then to the team. They must put a list of items in order according to their usefulness for facing the challenging situation. To do so, team members have to combine individual efforts and analyse the situation together, developing team processes that help them to achieve an optimum response. Specifically, we used adapted versions of *Bushfire survival* (Human Synergistics, 2018) for time 1; a fallout shelter task (Chiu & Staples, 2013) called "*survival in a bunker*" for time 2; and finally, *lost in the desert* (Lafferty et al., 1974) for time 3. On each task, participants had 10 minutes to order the items individually and 35 minutes for doing so as a group. After each session, data on all the variables used in this study were collected.

Team emotional management intervention. The TEM intervention was composed of two intervention sessions, each of which was divided into an individual exercise and a collective session. Each individual exercise lasted 25 minutes, and each collective session lasted 40 minutes. During the individual exercise, the participants learnt the content and applied it to specific problem-based activities. This exercise was performed on the computer-mediated communication platform to ensure that the compulsory individual activities were finished by all the team members before moving on to the next step. Then, in the group sessions, the whole team worked together on implementing the knowledge and skills learnt during the individual exercises. The first group session referred to the identification, expression, and regulation of emotions in virtual teams (i.e. paralinguistic cues, chronemics, and the proper use of emoticons to modulate the expression of emotions) (Kalman et al., 2013; Skovholt et al., 2014). The second session focused on training members in the management and regulation of the affective climate while interacting online (through strategies such as offering rewards to teammates who perform well, acknowledging contributions, re-evaluating negative situations, or supporting the team to

achieve shared goals). We conducted a manipulation check after completing each experimental task to ascertain that the intervention had been correctly perceived. Participants responded to a 10-item questionnaireabout the contents of the intervention and its implementation during the session, with behavioural indicators based on the explanations of the training.

Faultlines. To create the faultline, we performed a series of experimental manipulations to split virtual teams into subgroups of two participants each. This study created faultlines by aligning a characteristic called the "adventure profile" (thoughtful or bold profile) and their university of origin (University of Seville or Valencia). To assign the adventure profile, participants filled in a questionnaire where they indicated their preferences about a series of leisure activities. Some of them were more reflexive activities (thoughtful profile), whereas others were chosen by people more prone to risk (bold profile).

Moreover, based on previous literature (e.g. Rico et al., 2012), the faultline was activated by means of visual hints that communicated their differences. Participants had profile pictures with the colours and logos of their universities, as well as their adventure profiles. Moreover, we explicitly told them their own and the other subgroups' profiles in the pre-intervention session. We then conducted a manipulation check of identification with the subgroup to verify the correct perception of the assigned profile. This was done by explicitly asking to what extent they identified with their subgroup. To further strengthen the role of the faultline, we conducted a warm-up exercise. It was a zero-sum game that had to be played during the pre-intervention session. In this exercise, team members had to distribute economic resources between the two universities, but without giving 50% to each university. Finally, the participants first performed the first experimental task in couples within their subgroup, with the goal of emphasizing the perception of faultlines. In this case, they had 10 extra minutes to agree on the first part because the subgroups had to discuss the order before moving on to the group ordering.

Data Analysis Procedures

We carried out a set of preliminary analyses before testing the hypotheses. We also checked the validity of the measures through confirmatory factor analyses (CFA) to determine the ability of a predefined theoretical model to fit our empirical data (Brown, 2015). Due to the ordinal nature of our variables, we ran CFA by means of Mplus V7.4 using WLSMV estimation (Byrne, 2012).

Hypothesis 1 was tested using SPSS statistics V24. We proposed ANCOVA models to see whether there were differences between the two conditions (TEM intervention and control condition) in performance, using the measures at times 2 and 3 and controlling for time 1. Hypothesis 2 was tested by means of mediation analysis with the Process Macro for SPSS V3.4. Specifically, we ran process model 4 and entered TEM as the independent variable, each of the individual components of TCC as mediator, and team performance as dependent variable. In this study, TEM intervention was a dichotomous variable; teams in the control condition were assigned scores of zero, whereas teams in the experimental condition were assigned scores of one. We evaluated the indirect effects by means of the Bootstrapping approach. We obtained 5000 bootstrapped samples, creating a 95% bias-corrected confidence interval (CI). This test does not assume the distribution of the data to be normal, and it solves the problems associated with previous tests. When the CI does not include zero, the indirect effect is statistically significant and mediation exists.

Following the guidelines for mediation models, and based on

the rationale for our model, the predictor variable was a condition created at time 1, mediating variables were measured at time 2, and the criterion variable was measured at time 3. We also controlled for the mediating and dependent variables at time 1, avoiding artificially augmented estimates of the causal paths of interest (Cole & Maxwell, 2003). In order to assess the model fit of the CFA and mediation models, we examined different goodness of fit statistics: the comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and Weighted Root Mean Square Residual (WRMR). The classic cut-off values to conclude that there is good fit between the model and the observed data are close to 0.95 for CFI and TLI, close to 0.06 for RMSEA, and around 1 for WRMR (Byrne, 2012).

Results

Preliminary Analyses

Table 1 presents means, standard deviations, and Pearson correlations for the aggregated scores for the variables under analysis.

Table 1
Means, Standard Deviations, and Correlations for Study Variables

Variables	Mean	SD	1	2	3	4	5
1. Team trust T2	5.31	.49	(.96)				
2. Team commitment T2	4.57	.66	.66**	(.94)			
3. Team communication T2	5.3	.48	.78**	.78**	(.95)		
4. Team performance T2	8.54	.84	.77**	.66**	.81**	(.96)	
5. Team performance T3	8.7	.88	.57**	.41**	.53**	.69**	(.96)

Note. **$p < .01$ (two-tailed). Inter-item reliability values are in parentheses along the diagonal.

The table shows that the variables that compose TCC were measured at a concurrent time point (T2) and show high to very high inter-correlations. Thus, we ran a CFA to ascertain that TCC can be considered multi-dimensional in nature (Blomqvist & Levy, 2006) in our sample. We aimed to test the three-dimensional factorial structure to use it further in our analyses.

Therefore, as Byrne (2012) suggested, we conducted CFAs to check whether the set of items in each construct were measuring distinguishable variables (although correlated with the other variables) or were part of a single construct (TCC). We checked the different fit indexes (RMSEA, CFI, TLI, WRMR) in a three-factor model (items load in three different factors: trust, commitment, and communication) in comparison with an alternative one-factor model (all the items loading in a single global factor, TCC). We also tested the discriminant validity using a two-step approach. We compared the three-factor model with a constrained model with the correlations among the construct dimensions set to 1, as Anderson and Gerbing (1988) suggested.

The results of the CFAs are presented in Table 2. Only the three-factor model showed a good fit to the data according to the cut-off criteria (Byrne, 2012). Neither the one-factor model nor the constrained models met the cut-off points, and thus we used trust, commitment, and communication as three separate variables. We conducted a Chi Square Difference Test between nested models, and the results were satisfactory ($\Delta\chi^2 = 258$, $\Delta df = 6$, $p < .001$).

Table 2
Confirmatory Factor Analyses

Model	X^2/df	p	RMSEA	CFI	TLI	WRMR
Three-factor model	1.7	<.001	.06	.99	.99	.63
One-factor model	7.3	<.001	.17	.97	.96	2.3
Three-factor constrained model	9.9	<.001	.20	.96	.95	3.1

Manipulation Check Results

A specific scale was used to check whether the TEM intervention had been perceived. A sample item is "We used emoticons to smooth the written messages". The items were measured on a four-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). Cronbach's alphas for this scale were .81 in the pre-intervention session (time 1), .87 in the post-intervention session (time 2), and .89 in the 2nd post-intervention session (time 3). As in the previous scales, we also aggregated the data at the team level (Bliese, 2000). The mean for the $r_{wg(j)}$ was .85 ($SD = 0.11$) in the pre-intervention session, .84 ($SD = 0.12$) in the post-intervention session, and .82 ($SD = 0.16$) in the 2nd post-intervention session. The ICC (1) also showed adequate values, with a value of .22 in the pre-intervention session, .37 in the post-intervention session, and .38 in the 2nd post-intervention session. Thus, aggregation was justified. In this manipulation check, we compared the means of the experimental and control conditions on the use of TEM strategies while interacting together. Results showed that, as Table 3 shows, participants in the experimental condition used resources and strategies to manage their emotions during the virtual interaction more often than participants in the control condition in the post intervention session ($t_{(50)} = 2.33$; $p < .01$) and in the 2nd post-intervention session ($t_{(50)} = 3.73$; $p < .001$). As expected, there were no significant differences between groups in the pre-intervention session ($t_{(50)} = -1.40$; *ns*).

Table 3
Means and Standard Deviations of Each Condition in the Three Experimental Sessions

Session	Experimental	Control
Pre-intervention session	2.45 ($SD = 0.55$)	2.59 ($SD = 0.56$)
Post-intervention session 1	2.84 ($SD = 0.47$)	2.55 ($SD = 0.43$)
Post-intervention session 2	3.03 ($SD = 0.49$)	2.57 ($SD = 0.40$)

Regarding identification with the subgroup, we also checked the participants' identification with their assigned adventure profiles. Team members with the thoughtful adventure profile identified more with their profile ($M = 4.63$; $SD = 1.12$) than with the bold profile ($M = 3.33$; $SD = 1.41$) ($t_{(103)} = 8.03$; $p < .001$). Likewise, team members with the bold adventure profile identified with their assigned profile ($M = 4.39$; $SD = 1.22$) more than with the thoughtful profile ($M = 3.95$; $SD = 1.34$) ($t_{(103)} = 2.39$; $p < .05$). Therefore, participants correctly identified with the made-up characteristic that was part of the faultline.

Hypothesis Testing

In the case of Hypothesis 1, the results show that performance is higher in the experimental condition at both time 2 and time 3 than in the teams in the control condition (see Table 4). However, ANCOVA results show no significant differences between conditions at time 2 ($F_{(1,49)} = 3.64$, $p = .06$) or time 3 ($F_{(1,49)} = 1.32$, *ns*). Thus, Hypothesis 1 is not supported.

Table 4
Means and Standard Deviations of Team Performance Depending on the Condition (TEM Intervention or Control Group).

Variables	Mean (SD)	
	Intervention	Control
Team performance (Time 1)	8.03 (1.10)	8.2 (0.78)
Team performance (Time 2)	8.75 (0.70)	8.34 (0.92)
Team performance (Time 3)	8.82 (0.67)	8.58 (0.88)

Regarding Hypothesis 2, results of the mediation analyses show that TEM intervention was significantly related to trust (b= .27, p<.05) and commitment (b= .39, p<.05), but not to communication (b= .18, *ns*). However, the three TCC variables were positively related to performance: trust (b= 1.007, p<.001); commitment (b= .53, p<.01); and communication (b= .94, p<.001). Regarding the indirect effects, Hypothesis 2a is supported; the indirect effect shows that trust mediates the relationship between the TEM intervention and performance (ab product term = .27; BOOT S.E. = .08; 95% CI [.011 — .31]) because the CI did not include zero (Hayes, 2017). To further analyse the effect size of the mediation effect of trust, we computed the completely standardized indirect effect based on Preacher and Kelley's approach (2011). The result is .154, which can be considered a medium effect (Kenny, 2018).

Hypothesis 2b is also supported; commitment mediates the relationship between the TEM intervention and performance (ab product term= .21; BOOT S.E. = .12; 95% CI [.016 — .49]). The completely standardized indirect effect is .124, which can also be considered a medium effect (Kenny, 2018).

In the case of communication, the indirect effect was not significant (ab product term= .17; BOOT S.E. =.14; 95% CI [-.060 — .55]), and so Hypothesis 2c is not supported. In other words, commitment does not mediate the relation between TEM and performance.

Discussion

This research aimed to analyse whether a TEM intervention can enhance performance through the collaboration capability in virtual teams with faultlines. Our results show that an intervention for managing emotions in virtual teams with faultlines has a positive effect on performance through its influence on TCC, particularly highlighting the role of trust and commitment as mediating variables.

Specifically, our results did not support Hypothesis 1, which analysed the positive direct effect of TEM intervention on performance. Contrary to our results, past literature highlighted the positive relationship between emotion management and performance (Grandey & Melloy, 2017; Jordan & Troth, 2004; Michinov & Michinov, 2020), and suggested an emotion management intervention as a means to improve performance in face-to-face teams (Turner & Lloyd-Walker, 2008). These results could be explained by the presence of mediating mechanisms not initially considered in previous research, especially considering the lack of emotional management training studies in virtual teams. Hence, our results show that the TEM intervention had a positive indirect effect on performance through trust and commitment, partially supporting Hypothesis 2. These results may be explained by the computer-mediated communication context. Virtual teams are embedded in a complex and uncertain environment (Gilson et al., 2015) where the management of emotions does not directly increase performance, but it facilitates the development of personal links among team members through collaboration capabilities. Moreover, our results support the positive implications

of TCC for team outcomes in virtual teams (Batarseh et al., 2017, 2018): its three components are related to performance, even in teams with faultlines. Considering the relational framework for collaboration (Blomqvist & Levy, 2006), virtual teams with TCC will be able to handle interactions and build shared meanings in a way that increases their results. However, the TEM intervention did not improve communication. For virtual teams, communication may be a collaboration capability that mainly has an instrumental function due to the restrictions of the computer-mediated communication context (Altschuller & Benbunan-Fich, 2010). Virtual team members may not be experts in the use of virtual tools, and the lack of non-verbal cues may be affecting communication so that it has a different function, as some authors suggested in the collaboration framework (e.g. Morgan & Hunt, 1994). Hence, although communication is important in building relationships and performance (Marlow et al., 2018), it could require specific training in how to broaden communication capability functions in virtual teams.

These results make novel contributions to team and computer-mediated communication theory and research. Consistent with previous literature (Johnson et al., 2009; Pitts et al., 2012), our findings further support the importance of emotions and affect management in computer-mediated communication contexts, especially in virtual teams with faultlines. In accordance with SIP theory (Walther, 2015), by training virtual teams, computer-mediated communication can convey emotional information (Derks et al., 2008) that boosts team effectiveness. However, TCC plays a central role (Blomqvist & Levy, 2006) because we were able to improve performance through improvements in collaboration capabilities. We addressed the suggestion of continuing to analyse the influence of TCC in longitudinal designs and different contexts (Batarseh et al., 2017, 2018). Moreover, prior research used experimental approaches to team faultline reduction (Chiu & Staples, 2013; Rico et al., 2012) and pointed out the usefulness of training for deactivating faultlines (van der Kamp et al., 2015). Despite this, to the best of our knowledge, this is the first study to propose a TEM intervention to improve results in virtual teams with faultlines and test its effectivity in an experimental design. Whereas training is widely used to improve teamwork (Lacerenza et al., 2018), emotion management interventions have largely been neglected (Druskat & Wolff, 2001), and so this study provides evidence of the possibilities of TEM interventions. In addition, computer-mediated communication presents additional challenges that make the expression of emotions and regulation of affect even more relevant (Pitts et al., 2012). Previous research has studied emotion-related constructs in virtual teams (Mysirlaki & Paraskeva, 2020), but emotional management at the group level of virtual teams is still an emerging topic.

Moreover, the findings of this study have practical implications due to the generalization of computer-mediated communication and teamwork in global organizations (Mathieu et al., 2019; Pitts et al., 2012), especially due to the disruption caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), which represents a tipping point in the concept of work groups and strengthens the implementation of telework. In this context, virtual teams could become permanent because there is a high probability of new lockdowns and quarantines due to the risk of new COVID-19 outbreaks. This increasing use of virtual teams in organizations presents a unique challenge in their management (Gilson et al., 2015). First, not every team member operating now through virtual collaboration tools has enough computer-mediated communication literacy. Also, virtual teams bring together team members from different locations and cultural backgrounds; and companies need to enhance the

benefits of this diversity. Thus, this study provides suggestions about how to manage short-term project teams with subgroups working through computer-mediated communication. First, companies concerned with virtual teams' performance should train them in emotion management. TEM interventions provide team members with emotional strategies and resources that help them to express themselves, interact online, and understand their virtual colleagues, so that they can accomplish goals together even though they may never meet face-to-face. This intervention could facilitate the development of an emotional "safe environment" that fosters their relational capabilities, trust in the other members, and commitment to them. Moreover, our findings also have implications for computer-supported collaborative learning. Because these teams work with computer-mediated communication tools (e.g. Skype, Zoom, Blackboard Collaborate), the training can also be provided through this medium. We show that online training is a valid approach to improve virtual teams' competencies and performance. Finally, our results also highlight the importance of collaborative capabilities oriented towards building relationships among the members. Thus, organizations that use virtual teams should find ways to promote trust and commitment among team members working through computer-mediated communication contexts.

Limitations and Future Research

Despite its theoretical and practical implications, this study has some limitations. First and foremost, we used an experimental design with a sample of students to create project virtual teams. The use of an experimental design is considered a valid approach to real settings that increases the internal validity of the results; however, it has limitations in terms of external validity. Therefore, future studies should test our model in long-term field teams, aiming to replicate our results in real contexts with teams that have a shared trajectory and member stability, which could increase the benefits of a TEM intervention.

Second, our results are drawn from a rather small sample due to the experimental design with three different time points (Hahn & Lee, 2017), which could also influence the non-significant findings related to Hypothesis 1. However, our research addresses the temporal rationale required to test mediation, avoiding the problems associated with the use of cross-sectional data in communication and psychology research (Cole & Maxwell, 2003). In addition, the use of self-report data could induce common method bias, although the longitudinal design helps to reduce this bias. In any case, our results should be tested in bigger samples and using multiple sources of information (e.g. recording interactions or objective performance) to manage these potential issues.

Third, faultline creation and activation has been carried out following previous experimental studies (e.g. Chiu & Staples, 2013; Rico et al., 2012). However, the appearance of symmetric subgroups due to faultlines is rare in real settings. Thus, future research should design faultlines based on attributes such as hierarchy in an organization, authority, or salary, with asymmetric subgroups (e.g. department heads vs subordinates). Fourth, the use of a direct-consensus model (Chan, 1998) when aggregating the trust scale, while using a referent-shift consensus model for the commitment and communication scales, could limit the generalizability of these findings in relation to the TCC framework (Blomqvist & Levy, 2006). However, we should note that we found high within-group agreement, which allowed us to aggregate and compare data at the team level (Chan, 1998). In any case, future research should measure trust at the group level using referent-shift formulations in the items to overcome this limitation. Finally, we used one type of computer-mediated communication medium to conduct the research (text-based chat), but virtual teams in organizations have a broad array of computer-mediated communication tools (Altschuller & Benbunan-Fich, 2010). Thus, future studies should include other computer-mediated communication possibilities, such as videoconferencing.

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Notes

Availability of Data and Material

The anonymized datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethical Approval

All procedures performed in this study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.