

How Does Feedback Valence Improve Team Creativity by Influencing Team Relationship Conflict?

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Introduction: Team creativity is increasingly important to organizations, and the enhancement of creativity has become a key management challenge. Feedback is a very important management tool in the creativity enhancement process. Its use to enhance team creativity raises an important question, namely if positive or negative feedback valence affects team creativity. This is particularly important because researchers still only have a limited understanding of this impact.

Methods: This study adopts an experimental research method to explore the influence mechanism of feedback valence on team creativity. One hundred seven teams and 379 college students participated in experiments that lasted for a total of 1600 minutes.

Results: It is found that feedback valence positively affects team creativity and confirmed that positive feedback (relative to negative feedback) is more conducive to team creativity. Team relationship conflict is also found to mediate the relationship between feedback valence and team creativity. Positive feedback helps to reduce team relationship conflict, which (indirectly) positively affects team creativity; negative feedback increases team relationship conflict, which (indirectly) negatively affects team creativity. Meanwhile, creative time pressure moderates the relationship between: 1) feedback valence and team creativity; and 2) feedback valence and team relationship conflict.

Discussion: The research results do not just enrich theoretical research (into feedback valence, team relationship conflict, creative time pressure and team creativity), as they also provide valuable inspiration to managers seeking to improve team creativity in management practice.

Keywords: creative time pressure, feedback valence, team creativity, team relationship conflict

Introduction

Creativity, which can be demonstrated at any level and by any employee,¹ has a vital role to play in improving any organization's performance. Creative work requires creation, and access to external feedback can increase personal ideas. The individual can enhance creative performance can be enhanced by taking the perspectives of others and then combining them with their own.²

Some early research established a link between feedback and creativity, by demonstrating how the former can positively impact the latter.^{3,4} Of the different feedback-related variables, feedback valence was found to be a particularly effective tool. Feedback valence is one of the most fundamental dimensions of feedback, which refers to the degree of positivity or negativity of the difference between team creativity and applied criteria.⁵ It has also been suggested that feedback valence affects creativity at the individual level.⁶ In assessing the social nature of creativity, it is necessary to consider how individual creators interact with others to develop ideas.⁷ It is unlikely that an individual-level perspective will provide insight into how feedback valence affects creativity, and so a unique team-level perspective is required. Teams, as an efficient and flexible system within organizations, are a powerful tool they can use to solve problems in a rapidly changing business environment⁸. When compared to individuals, the teamwork system is seen to be more

conductive to the extraction and development of creative ideas.⁹ The study of how feedback valence (positive and negative) impacts creativity at the team level is therefore of both theoretical and practical significance.

Teamwork will inevitably encounter the problems of team task conflict and relationship conflict.¹⁰ In recent years, the impact of team conflict on innovation has been extensively studied by both organizational practice and theoretical researchers,¹¹ who have addressed questions such as the relationship between innovation and creativity/interactive behaviors (eg team task and relationship conflict.¹² In comparison, less consideration has been given to the effects of team conflict on team performance and team creativity¹³ and team task conflict on team creativity¹⁴. Relationship conflict is always part of work teams, and numerous empirical studies confirm the negative effects of relationship conflict on teams and individual members.^{15,16} It is also instructive to refer to some meta-analyses, which observe how relationship conflict has significantly damaged outcome variables;¹⁷ To some extent, relationship conflict will weaken the innovative behavior of team members¹⁸ and will more generally negatively affect team creativity.¹⁹ Chinese people find it hard to maintain bad relations with others because their culture stresses the importance of harmony. But once things break down, harmony will not easily be restored as there is a need to “save face”, and this is why relationship conflict is more harmful in China than in the West.¹⁰ When hostilities break out, only a clear understanding of team relationship conflict and reasonable management will help to promote corporate development, and this is why it is extremely important to study the factors that influence team relationship conflict. There is only a limited literature on the factors that influence team relationship conflict, and a sound theoretical foundation is still lacking;²⁰ as a result, the interpretation of the negative correlation between team relationship conflict and team performance/other indicators is still very much subjective.⁸

Existing research into the antecedent variables of team relationship conflict addresses other conflict types;^{21,22} conflict management strategies;^{23,24} team members’ perceptions of demographic traits;^{25,26} values²⁵ and personality;^{27,28} heterogeneity in team leader exchange (LMX) differences; and the overall level of middle-of-the-road thinking among team members.²⁰ Chinese corporate managers are generally not good at publicly expressing their views, and this is especially true when they believe this may lead to conflict with others.²⁹ When external feedback is received, it can increase personal ideas and improve creative performance.² We are therefore going to study if feedback valence is an antecedent variable of team relationship conflict, and will also ask if team relationship functions as a mediating mechanism in the interaction between feedback valence and team creativity. We anticipate that the research findings, in addition to similar research, will not only make a practical contribution by reducing conflict in team relationships, but will also enrich the literature on feedback valence and mechanisms that mediate team creativity.

In recent years, the imperative of “accelerating innovation” has been frequently mentioned in government work reports. As digitalization accelerates, the time window of enterprise life, product life cycle and user competition is shortening at an unprecedented rate,³⁰ and the key factors which affect organizational competition have changed, with resources and capabilities being surpassed by speed and time³¹. In seeking to improve market competitiveness and gain a head start amidst fierce competition, companies often choose to shorten the product renewal cycle. Employees, as the main human resource of corporate innovation activities, frequently encounter the problem of creative time pressure, which means they lack sufficient time to complete their innovation tasks.³² Creative time pressure is the extent to which employees believe they have insufficient time to develop ideas at work,³³ and it is closely related to creativity. The “Workplace Stress Report in China”, which was published by LinkedIn.com, states that almost half (44%) of respondents experience great stress at work because of time problems.³⁴ Time pressure has become a generally important issue in the innovation process and the results of its impact on innovation behavior have been controversial. Scholars have found time pressure and creativity are positively correlated,³⁵ and have suggested that high time pressure inhibits creativity;³⁶ However others have, in referring to five different groups (including government laboratories and educational institutions) claimed the two are not significantly related.³⁷ In summary, studies have presented inconsistent findings, and further research is still required. This study focuses in particular on the effects of creative time pressure on feedback valence, team relationship conflict and team creativity.

On the basis of the preceding analysis, we identify leaders who have an important influence on team members and use them to explore the influence that leadership factors have on team relationship conflict and team creativity by applying a leadership feedback valence perspective. In referring to Feedback Intervention Theory, we develop a theoretical model based on the IPO model of team process operation;³⁸ it is developed from a creative time pressure perspective, and

creative time pressure, feedback potency and team relationship conflict are integrated into its research framework. We reveal the effect of feedback valence on creativity by engaging at the team level, and explore how feedback from different valences affects team creativity by stimulating team relationship conflict and the moderating effect of creative time pressure. However, this study extends beyond the limitations of previous studies into the impact of feedback valence mechanism on creativity, which only engage from cognitive, informational and motivational perspectives, and makes a specific contribution by expanding Feedback Intervention Theory; in addition, it enriches the literature on team relationship conflict and team creativity, and also provides a theoretical basis for addressing issues related to reduced team relationship conflict.

Theoretical Background and Hypothesis

Feedback Valence and Team Creativity

One study found that employees whose creative efforts were supported by their supervisors came to believe creativity was an expected and valued aspect of their performance.³⁹ Creative work generally evolves through five stages; the first three involve creative workers identifying problems, finding information and generating possible solutions (task presentation, preparation and idea generation), and the final two are focused on feedback. Creative workers need to find “openings” in the feedback that will enable them to explore further; feedback will enhance the creativity of re-conceptualization, and will enable employees to perceive new connections through different perspectives, and this will enable them to handle problems in different ways; feedback will also allow employees to combine different perspectives in unique ways or to re-establish existing knowledge and information that may help to create new ideas; In addition, it can positively influence the performance of creative work, and this can often lead to the generation of more ideas.⁴

Feedback valence is one of the most fundamental dimensions of feedback, and it includes both positive and negative feedback. The former indicates that an individual’s idea is more creative than the standard, and that it contains positive social evaluation information about the individual’s ability and value – this is why it is considered a positive motivator and a “face-saving” behavior;⁴⁰ the latter, in contrast, shows an individual’s idea is less creative than the standard.³ But there is a lack of clarity on the relationship between feedback valence and creativity, and this is most likely due to the contradictory theoretical and empirical evidence: for example, while some assert that positive feedback positively affects creativity, others claim it inhibits creativity. Research into the relationship between negative feedback and creativity similarly contains a mixture of different claims: some contend it does not directly affect recipients’ creativity,⁴¹ while others contend it is positively related to⁴² or impedes creativity.⁴³ The literature on the relationship between negative feedback and recipient creativity similarly posits a range of (positive, negative and null) relationships.⁴⁴

Positive feedback aims to help employees to better complete their jobs in the expectation this will improve their performance, enable them to better achieve their goals and contribute to the emergence of positive goals (performance differences).⁴⁵ In addition, it may also elicit a general belief in team members’ abilities.^{46,47} Negative feedback instead causes participants to adjust their goals downward. After it is asserted in extreme form or repeated, most will give up or their desire to work hard will be greatly reduced.⁴⁵ When it is whitewashed or distorted, it decreases organizational learning and innovation reduces as a result.⁴⁸ Feedback in a top-down feedback stream through a meta-process (a mental state in which the recipient perceives the threat of negative feedback) can also block the recipient’s creativity.⁴⁴ When a team (rather than an individual) is an information processor, it will exhibit significantly different characteristics such as dependence on the environment and de-personalization,⁴⁹ which could increase or decrease attention to task information. Creativity has traditionally been considered to be the result of individual genius and unique individual characteristics.⁵⁰ However, recent research instead suggests it is often a social achievement in which people collaborate to generate ideas, which they then use to refine prototypes and ultimately produce products that collaboratively embody team rather than individual efforts.⁵¹ The increased novelty and usefulness of the creative work process are not therefore attributable to the individual, but rather to novel connections between teams that may in turn produce useful ideas that can be applied in a wide range of contexts. When team creativity is compared to its individual counterpart, it becomes apparent that it has a number of unique characteristics. Hence, findings on the relationship between feedback valence and individual creativity are unlikely to be fully applicable at the team level; and its oversight of the interdependent nature of team

creativity is also a problem. Creative teams exist precisely because teams have greater cognitive potential.⁵ We accordingly predict that:

Hypothesis1: Feedback valence positively affects team creativity, and positive feedback (as opposed to negative feedback) is more conducive to team creativity.

The Mediating Role of Team Relationship Conflict

Team conflict is a perception-generating process in which team members are incompatible or mutually exclusive.⁵² The two-dimensional structure of task conflict and relationship conflict that Jehn proposes is the most widely-applied way of classifying team conflict,¹¹ and Lang Chungang, in addition to other observers, has confirmed it can also be applied in China,⁵³ We therefore adopt this structure and classify team conflict into task and relationship conflict. The former is disagreements among team members about the content or idea of the work, and is understood as a cognitive conflict “about the matter but not the person”. The latter is interpersonal conflict¹⁵ related to disagreement on an interpersonal basis (eg, differences in norms, personality, norms etc), that is attributable to a host of discordant factors, including boredom, hostility and tension.²³ It is a conflict between circles, and is essentially a conflict between various “identity archetypes”⁵⁴ that occurs so frequently in team settings that it should be viewed as inevitable.⁵⁵ It is detrimental to organizations at any stage¹⁵ and is therefore viewed as destructive⁵⁶ and a negative impact on team creativity.¹³

Information Processing Theory maintains that team relationship conflict takes time and energy that team members should commit to specific tasks, and diverts it to individuals, which in turn limits the team’s ability to process information.⁵⁷ This type of conflict also causes team members to commit more time and energy to coordinating interpersonal relationships, and this distracts them.⁵⁸ When the team members are focused on relational conflicts, they are less able to think about solutions to team problems, in large part because their ability to think creatively is undermined⁵⁹ and it is less likely the team will generate innovative ideas.¹³ Relationship conflict causes tension, hostility, and alienation among team members; decreases trust and satisfaction among colleagues; harms the atmosphere of team unity and harmony; reduces communication and cooperation among members; and is detrimental to employees’ innovative behavior.¹⁰ Emotional Social Exchange Theory also establishes that the negative emotions that are produced can obstruct social exchange and interpersonal interaction among members. This can undermine the flow of information and the formation of interaction mechanisms in the team, which is important because they both sustain team innovation⁶⁰. Negative interactions caused by relationship conflict can hinder information processing in the team, inhibit team innovation⁵⁴ and negatively affect team creativity.

Increased relationship conflict is associated with more negative conflict-related evaluations and blame.⁶¹ And supervisor feedback (positive or negative) can produce changes in employee relationships or the team climate that negatively impact the team’s productive performance.⁶² Negative feedback negates the value of team members and hinders their common aspirations for the future; in addition, it tends to trigger dissatisfaction and confrontation among team members, which in turn leads to increased team relationship conflict. When the level of team relationship conflict is high, members will tend to attribute the different perspectives and solutions of others to interpersonal conflict and resist their suggestions and opinions (especially critical ones, which will be perceived as negative feedback⁵⁹); they will also be unwilling to accept the opinions of others or to take inspiration/new ideas from them.¹⁴ In contrast, positive feedback shapes positive interrelationships, provides positive psychological benefits to team members, enhances team member trust in the leader, and reduces incompatibility and inconsistency in leader-member relationships (this helps to reduce relational uncertainty and mitigate the level of team relational conflict, which may in turn positively influence team creativity). Previous research also suggests feedback valence positively influences team creativity and that emotional presence mediates the relationship between feedback valence and team creativity.⁶³ A sense of positive emotional presence may reduce relationship conflict. We therefore hypothesize that a positive feedback intervention through feedback valence will, to some extent, increase positive emotional presence, and propose this could reduce team relationship conflict and (indirectly) positively affect team creativity. On this basis, we propose the following hypotheses:

H2a: Team relationship conflict mediates the relationship between positive feedback and team creativity. Positive feedback negatively affects team relationship conflict, and may in turn (indirectly) positively affect team creativity.

H2b: Team relationship conflict mediates the relationship between negative feedback and team creativity. Negative feedback positively affects team relationship conflict, and may (indirectly) negatively affect team creativity.

The Moderating Effect of Creative Time Pressure

Time pressure is the degree to which employees feel they do not have sufficient time to complete work tasks or feel under pressure to complete work faster than usual,⁶⁴ and creative time pressure is the extent to which employees feel they do not have enough time to develop ideas at work.³³ Time pressures impose themselves⁶⁵ and can change an individual's intrinsic motivation and psychological burden, and affect their creativity level.⁶⁶ Previous studies have mainly investigated the relationship between time stress and creativity by investigating the relationship between time stress and creativity. In doing so, they have engaged at the individual level and applied Cognitive Resource and Activation Theory to assess the stress level or stress itself. This has produced four research findings, specifically a positive correlation between time stress and creativity,⁶⁷ a negative correlation,⁶⁸ an inverted U-shaped relationship⁶⁹ and uncorrelation.⁷⁰ While some studies have found that challenging (creative) time pressure promotes individual creativity and that impeded time pressure reduces individual creativity,⁶⁶ there is a lack of systematic evidence about the importance of the influence of creative time pressure for team creativity processes.

Innovation is a step-by-step process that requires deep consideration, and time pressures severely impact employee creativity because they need time to engage in creative cognition.⁷¹ Pressure takes up too much of an individual's cognitive resources and this in turn limits their creativity.⁷² High time pressure reduces their ability to engage in exploratory thinking, they in turn come to rely on familiar approaches to problems, which reduces creativity.³⁶ Creative time pressure can impede employees' creative performance; when they devote a portion of their limited pool of cognitive resources to managing experienced creative time pressure, they have fewer cognitive resources available for other tasks.⁷³ Those who experience time pressures are less likely to engage in creative cognitive processing. In contrast, those who experience these pressures to a lesser extent have sufficient time to combine and integrate different perspectives; and their cognitive processes, such as cognitive flexibility, divergent thinking and remote association, are less likely to be limited.⁷⁴

Feedback that over-emphasises speed can produce an over-supply of employees engaged in innovation activities, and can even produce too many low-quality innovations.³² Creative time pressure significantly limits the potential use of available cognitive resources,⁷⁵ and may affect the effectiveness of feedback and creativity-related cognitive processes.⁷⁴ Those who experience high time pressure often tend to use simple information processing strategies to speed up information processing.⁷⁶ When employees have sufficient time to access and process the available information and generate alternative ideas, they will get more from the feedback they receive,⁷³ and will be able to conceptually reconfigure individual feedback items and turn them into their own ideas.⁷⁷ Even once time requirements for processing feedback are taken into account, feedback workshops are important, and are even a prerequisite, for performance improvement.⁷⁸ Low creative time pressure provides employees with the opportunity to use feedback, which leads to an exponential increase in creativity.⁷³ On this basis, this study proposes:

H3a: Creative time pressure moderates the relationship between feedback valence and team creativity. When creative time pressure is low, feedback valence has a greater (positive) impact on team creativity;

H3b: Creative time pressure moderates the relationship between feedback valence and team creativity. The positive effect of feedback valence on team creativity is attenuated when creative time pressure is high.

Subjective time pressure at work is a key predictor of burnout and compassion fatigue.⁷⁹ When there is uncertainty of innovation work, high innovation output performance goals and a time-pressured environment, it is more likely that relationship conflicts will occur in teams. High time pressure is a "time crunch" that compels employees to be more efficient. Employees could experience negative emotions as a result, which may in turn increase team relationship conflict. Here it should be remembered that when there is low time pressure, employees will more easily show

cheerfulness, focus and joy, with the result that relationship conflict will (generally) reduce. Leaders also have more time to provide positive feedback when creative time pressure is low – they have more time to consult with the team, and this collaborative consultation can reduce the level of relational conflict.⁸⁰ Creative time pressure affects the positive or negative psychological experiences that result from feedback validity:⁸¹ high creative time pressure enhances the negative psychological experiences that negative feedback produces, and this leads to a disproportionately negative mood and also possibly increases conflict in the team. Low creative time pressure may enhance the positive psychological experiences produced by positive feedback, positively influence leadership interrelationship and reduce team relationship conflict. Finally, it may also strengthen the relationship between feedback efficacy and team relationship conflict. On this basis, this paper proposes the following hypothesis:

H4a: Creative time pressure mediates between feedback valence and team relationship conflict. The (negative) effect of feedback valence on team relationship conflict is greater when creative time pressure is low;

H4b: Creative time pressure mediates between feedback valence and team relationship conflict. The (negative) effect of feedback valence on team relationship conflict is weaker when creative time pressure is high.

On the basis of the preceding analysis, a research model is developed (see Figure 1).

Research Design

Experimental Design and Participants

In common with the only previous study of the relationship between feedback valence and team creativity, we use experimental methods to test hypotheses,⁸² in addition to other benefits, this will enable us to explore how relational conflict mechanisms in the feedback valence impact team creativity. We use experimental manipulation to measure feedback validity, and its randomization ensures the internal validity of the findings. The effect of feedback valence on relational conflict in teams has been found to be more accurate when measured in an appropriate period after the feedback valence manipulation is completed, and this influenced this study's experimental approach. A total of 415 students from a Chinese university participated in the experiment, and they were separated into 118 teams (of 3–4 members) that were randomly assigned to the experimental conditions. Teams that completed the task received extra points for their course grades. After eleven teams with incomplete data were removed, the final data sample consisted of 107 teams and 379 students (39.8% of whom were female). The experiment lasted about one year and was conducted in 10 classes: each experiment lasted about 160 minutes, and its total time was therefore around 1600 minutes.

Experimental Tasks and Procedures

Experimental Task

The experiment was adapted from a creative task.⁸² Participants were asked to imagine they were part of a team managing a theatre and were responsible for developing a creative action plan for its future development. They first had

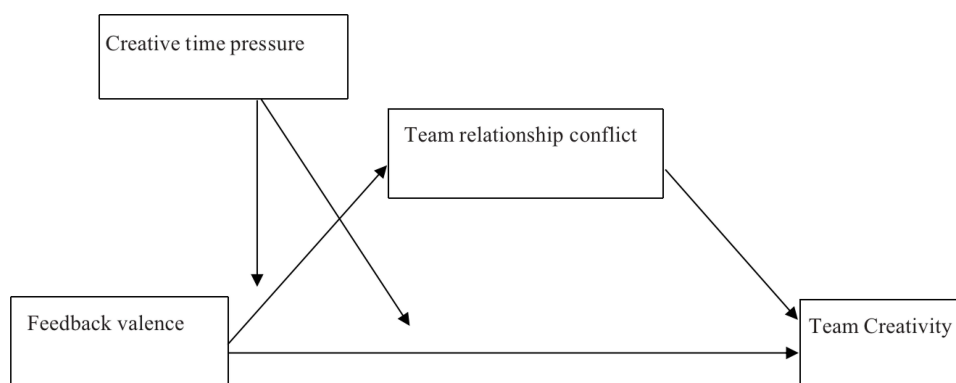


Figure 1 Research model.

to learn their role descriptions (which included artistic director, event manager and financial manager) and read through information about the theatre. After reading through the description, they had a clearer understanding of their responsibilities: the artistic director would ensure a high creative reputation, the event manager would focus on upholding the quality of service and community involvement; and the financial manager would improve financial performance. Additional information was provided about the schedule (over the seven-day week, two plays were performed in the morning, two in the afternoon and one in the evening) and floor plan. Each member was then asked to write down in the plan what they considered to be important goals and to also suggest initial ideas for task completion. After individual tasks were completed the team task began, which consisted of submitting a complete creative action plan for improving the theater's team performance and becoming better accustomed with the applied definition of "creativity" (the novelty and practicality of an idea). The team that best completed the plan would receive extra course points.

Experimental Procedures

The experiments had six procedures: All of these six procedures were completed in one experiment (one experiment lasted for around 160 minutes). All data collection was carried out in 10 classes over a single year, and the total experiment time was about 1600 minutes. Procedure 1: Personal Creativity Test. Within a period of 25 minutes, each participant wrote down what they thought was most important for the achievement of the creative plan. Procedure 2: Creative Time Pressure Measurement. Within a period of 10 minutes, each participant completed a questionnaire. Procedure 3: Team Task Implementation. Within a period of one hour, participants "worked" as the theatre's management team. They developed a creative action plan for the theater and submitted a complete action plan. Procedure 4: Feedback Valence Intervention. Team members spoke for 20 minutes before a researchers collected their ideas and gave them virtual feedback. After being given feedback on the first round of creative results (positive or negative) in the form of a Feedback Checklist score, they were then asked to adjust their action plans. Procedure 5: Submitting a New Creative Action Plan Based on the Feedback. Within a period of 30 minutes, teams adjusted their plans on the basis of the feedback list and submitted a final action plan. Procedure 6: Post-Experiment Survey. Participants completed a short post-experiment survey that included basic information (age, gender, and familiarity of leadership members) and items that required more extensive reflection and feedback (including "manipulation check perceptions of feedback valence", "team relationship conflict" and "team creativity").

Feedback Valence Manipulation

This was achieved by giving teams a feedback checklist halfway through the team task.³ This gave the team rankings related to the novelty, overall creativity and usefulness of their plan, which were established by referring to the plans of other teams from the previous study. On the side of each dimension in the feedback inventory form, there was a space where the experimental manipulator entered a number that indicated the percentage ranking that the team plan received. Providing feedback in the form of comparisons to interpersonal criteria (eg prior team creativity) is consistent with previous research on feedback valence and creativity;³ in addition, it also acknowledges and reflects the relative and subjective nature of creativity judgments.⁸²

Variable Measurements

The study's key variables ("team relationship conflict" and "creative time pressure") were measured by using advanced foreign scales. The measurement of "feedback valence" and "team creativity" was not based on scales developed by previous scholars, but rather on experimental manipulation, which involved referring to the experimental process and variable measurement methods developed by foreign researchers. With the exception of the control variables, other variables were evaluated by using the 7-point Likert scale.

(1) Feedback valence. Feedback valence is the (positive or negative) value of the difference between a team's creativity and the applied criteria. Teams were informed, through a feedback checklist, of how their plan ranked in terms of novelty, overall creativity and usefulness. Teams that received negative feedback were told their plan was 20% more novel, 25% more creative and 30% more useful. Teams that received positive feedback were told that their plans were 80% more useful, 75% more creative and 70% more novel. In order to test the validity of the feedback valence

manipulation, participants were asked to complete a feedback valence perception questionnaire. Sample items included: “Our initial solution was very creative compared to other teams performing this task”. The alpha coefficient for perceived feedback valence was 0.94.

(2) Team relationship conflict Jehn (1995)’s team relationship conflict scale was used, and participants were asked four questions.¹ (“What is the degree of friction between members in your work team?”; “What is the degree of obvious personality conflict in your work team?”; “What is the degree of tension in your work team?”; “To what extent did emotional conflict occur between members of your work team?”.) Team relationship conflict is a team-level variable, and the relevant question items are filled in by team members and aggregated to the team level during data analysis. The alpha coefficient for team relationship conflict was 0.82.

(3) Creative time pressure. We apply Basadur et al’s scale and ask 12 questions. The alpha coefficient of creative time pressure was 0.93.

(4) Team creativity. Novelty and usefulness were used as indicators of team creativity. Plans consist of one or more interrelated ideas, and each plan was therefore evaluated for novelty and usefulness by referring to constituent ideas in four dimensions (creative reputation, financial performance, community involvement, and service level). The results were then coded separately for each dimension, ranging from 1 (not novel/not useful at all) to 7 (very novel/not useful). This produced a total of 8 scores. The team creativity score was then obtained by averaging the novelty and usefulness of each idea in the team plan. Team creativity was measured in 2 separate experiments. One measured team creativity before the feedback valence intervention and the other afterwards. Subsequent analyses used the difference between the post and pre-test team creativity as the team creativity measure. The alpha coefficient for both pre and post-experimental team creativity was 0.93.

Data Analysis

We used Mplus 7.0 and SPSS 23.0 software.

Manipulation Test

In accordance with the expected results of the manipulation, the ANOVA test for the feedback valence manipulation yielded a significant main effect, $F(1106) = 218.94$; $p < 0.001$, $\eta^2p = 0.68$. The mean of positive feedback perceptions in the positive feedback condition ($M = 5.33$, $SD = 0.66$) was higher than the counterpart measure in the negative condition ($M = 2.55$, $SD = 1.16$). These results suggest that the manipulation of feedback valence was more successful in causing negative feedback condition participants to perceive their ideas as less optimal (creative, novel and useful).

Homogeneous Analysis of Variance

Table 1 illustrates that the four-factor model (perceived feedback valence, team relationship conflict, creative time pressure, and team creativity) fits well ($\chi^2 = 793.16$; $df = 371$, $\chi^2/df = 2.14$; CFI=0.94; TLI=0.94; RMSEA=0.06) and outperforms the other nested models, which indicates good discriminant validity among the variables. This confirms that this study’s measurement is reliable, has good structural properties and is suitable for subsequent data analysis.

We test for common method bias by using a common method latent factor (CMV). The homology factor was added to the four-factor model. It was found that after the addition of the CMV, there was no significant improvement in each

Table 1 Results of Validation Factor Analysis

Measurement Model	χ^2	df	χ^2/df	CFI	TLI	RMSEA	SRMR	$\Delta\chi^2/\Delta df$
CMV	815.44	353	2.31	0.94	0.93	0.06	0.07	/
Four Factor Model (PFG,RCF,CTP,TC)	793.16	371	2.14	0.94	0.94	0.06	0.05	1.24
Three Factor Model (PFG+RCF,CTP,TC)	1460.37	374	3.90	0.85	0.84	0.09	0.10	222.41
Two Factor Model (PFG+RCF+CTP,TC)	3998.51	376	10.63	0.51	0.47	0.16	0.22	1269.07
One Factor Model (PFG+RCF+CTP+TC)	5430.24	377	14.40	0.32	0.27	0.19	0.23	1431.73

Abbreviations: PFG, Feedback valence; RCF, Team relationship conflict; CTP, Creative time pressure; TC, Team Creativity.

fitting index. When compared with the four-factor model it showed a better fit, which indicates there was no significant homologous method bias in the study model.

Data Aggregation Test

This study is a team-level study, which requires the aggregation of individual measurement data. Of the core variables involved, team creativity was directly scored by the evaluators for the team creativity results before and after feedback, as it is already team-level data that does not need to be aggregated. Other variables (perceived feedback validity, team relationship conflict, and creative time pressure) were derived from team member perceptions. Data were collected at the individual level, and it was necessary to examine the consistency of team members' perceptions before data analysis to ensure that individual-level data could be aggregated to the team level. Table 2 shows that the Rwg (mean) and Rwg (median) for perceived feedback valence, team relationship conflict, and creative time pressure were all greater than 0.70; the values of ICC1 for both variables ranged from 0.10 to 0.50; and only ICC1 > 0.50 for perceived feedback valence, which indicated there were more appropriate between-group differences in the variables; ICC2 for one variable was greater than 0.70 and the remaining two variables had ICC2 > 0.50 (one was close to 0.70), which demonstrated these three variables had better intergroup reliability. We therefore conclude the Rwg, ICC1 and ICC2 values of the three variables meet the criteria and are suitable for aggregation to the team level.

Descriptive Statistical Analysis of Variables and Correlation Coefficients

Table 3 shows the results of descriptive statistical information and correlations. Feedback valence was significantly correlated with team creativity ($r_{\text{partial}} = 0.34$, $p < 0.001$); feedback valence with team relationship conflict ($r_{\text{partial}} = -0.33$, $p < 0.001$); and team creativity with the mediating variable team relationship conflict ($r_{\text{partial}} = -0.40$, $p < 0.001$).

Hypothesis Testing

Hypothesis 1 asserted that “feedback valence positively affects team creativity, and positive feedback (as opposed to negative feedback) is more conducive to team creativity”. In order to test these propositions, an ANOVA analysis of feedback potency and team creativity was conducted by SPSS. The results indicated that team creativity was significantly different between the negative ($M = 1.09$, $SD = 1.10$) and positive feedback conditions ($M = 1.93$, $SD = 1.12$), $F(1106) = 15.418$, $p < 0.001$, $\eta^2_p = 0.13$. We then performed a repeated measures ANOVA. Feedback valence was the independent variable, and team creativity on the pretest and posttest were the outcome variables. The main effect of time was found to be significant ($F = 197.31$, $p < 0.001$, $\eta^2_p = 0.65$). The interaction effect of time and feedback valence was also

Table 2 Results of Aggregation Tests for Team-Level Variables

Variables	R _{wg} Median	R _{wg} Mean	ICC1	ICC2
Perceived feedback valence	0.90	0.77	0.70	0.89
Team relationship conflict	0.92	0.87	0.26	0.56
Creative time pressure	0.94	0.90	0.37	0.68

Table 3 Results of Descriptive Statistical Analysis

Variables	M	SD	1	2	3	4
1. Creative time pressure	3.37	0.90				
2. Feedback Valence	0.45	0.50	-0.06			
3. Feedback valence manipulation check	3.80	1.70	-0.05	0.82**		
4. Team relationship conflict	3.11	0.85	0.19	-0.33**	-0.25*	
5. Team creativity	1.47	1.18	0.001	0.36**	0.39**	-0.42**

Notes: Feedback valence is a dummy variable (0=negative feedback); all correlations are reported at team level; * $P < 0.05$, ** $P < 0.01$.

significant, ($F = 15.42$, $p < 0.001$, $\eta^2p = 0.13$). After positive feedback, team creativity on the posttest ($M = 5.63$, $SD = 0.94$) was found to be significantly higher than team creativity on the pretest ($M = 3.70$, $SD = 0.93$). Hypothesis 1 was therefore accepted.

Hypothesis 2 asserted that “team relationship conflict mediates the relationship between feedback valence and team creativity”. In order to test this proposition, a simple mediation test was conducted by using model 4 in the process procedure. Before testing, all variables were standardized (see Table 4). M1 in Table 4 shows feedback valence has a positive effect on team creativity ($b=0.33$, $p<0.001$). M2 in Table 4 demonstrates that feedback valence has a negative effect on team relationship conflict ($b=-0.32$, $P<0.001$). And M3 confirms team relationship conflict has a negative effect on team creativity ($b=-0.31$, $P<0.01$). When team relationship conflict was added, the effect of feedback valence on team creativity was found to be significant ($b=0.23$, $p < 0.05$). Team relationship conflict partially mediated the effect between feedback valence and team creativity (indirect effect value of 0.10, $SE=0.04$, Boot 95% $CI=[0.0411, 0.1994]$), and Hypothesis 2 was therefore accepted.

Hypothesis 3 asserts that

Creative time pressure moderates the relationship between feedback valence and team creativity. When creative time pressure is low, the positive effect of feedback valence on team creativity is stronger; conversely, when creative time pressure is high, the positive effect of feedback valence on team creativity is weaker.

Hypothesis 4 asserts that

Creative time pressure moderates the relationship between feedback valence and team conflict. When creative time pressure is low, the (negative) effect of feedback valence on team relationship conflict is stronger; inversely, when creative time pressure is high, the (negative) effect of feedback valence on team relationship conflict is low.

Table 4 Results of Mediating Effect Analysis

Variables	Team Creativity			Team Relationship Conflict			Team Creativity		
	M1			M2			M3		
	b	SE	Boot 95% CI	b	SE	Boot 95% CI	b	SE	Boot 95% CI
Control variables									
Age of the team leader	0.28**	0.10	[0.0844, 0.4788]	-0.13	0.10	[-0.3280, 0.0778]	0.24*	0.10	[0.0535, 0.4317]
Gender of the team leader	-0.10	0.10	[-0.2934, 0.0988]	0.04	0.10	[-0.1666, 0.2371]	-0.09	0.09	[-0.2731, 0.1005]
Familiarity of the team leader with the members	-0.03	0.09	[-0.2135, 0.1493]	-0.13	0.09	[-0.3164, 0.0570]	-0.07	0.09	[-0.2467, 0.1019]
Independent variables									
Feedback valence	0.33***	0.09	[0.1525, 0.5080]	-0.32***	0.09	[-0.5070, -0.1411]	0.23*	0.09	[0.0502, 0.4086]
Mediating variables									
Team relationship conflict							-0.31**	0.09	[-0.4929, -0.1295]
F	6.07***			4.30**			7.66***		
R2	0.19			0.14			0.28		
Indirect effect	Mediating variables			Effect Value		SE	Boot 95% CI		
	Team relationship conflict			0.10		0.04	[0.0411, 0.1994]		

Notes: (1) The number of self-replicated sampling samples (bootstrap samples) used to estimate the bias-corrected confidence interval is 5000. (2) All correlations are reported at team level; * $P<0.05$, ** $P<0.01$, *** $P<0.001$.

Table 5 Regression Analysis of the Mediated Model with Moderation

	b	SE	t	Boot 95% CI	F	R²
M4: Team Relationship Conflict					4.94**	0.23
The age of the leader	-0.11	0.10	-1.10	[-0.3040, 0.0871]		
Gender of the leader	0.09	0.10	0.86	[-0.1113, 0.2829]		
Leader's familiarity with employees	-0.07	0.09	-0.80	[-0.2574, 0.1101]		
Feedback valence	-0.31***	0.09	-0.35	[-0.4872, -0.1357]		
Creative time pressure	0.17	0.09	1.81	[-0.0159, 0.3528]		
Feedback valence × Creative time pressure (High Level)	0.26**	0.09	2.94	[0.0858, 0.4430]		
M5: Team creativity					10.62***	0.43
Age of the leader	0.26**	0.09	3.05	[0.0912, 0.4315]		
Gender of the leader	-0.11	0.09	-1.31	[-0.2843, 0.0580]		
Leader's familiarity with employees	-0.08	0.08	-1.05	[-0.2434, 0.0755]		
Feedback Valence	0.26**	0.08	3.21	[0.0994, 0.4217]		
Creative time pressure	0.04	0.08	0.54	[-0.1177, 0.2064]		
Feedback valence × Creative time pressure	-0.41***	0.08	-5.00	[-0.5664, -0.2444]		
Relationship conflict	-0.21*	0.09	-2.37	[-0.3764, -0.0332]		

Notes: Feedback valence is dummy coded (0=negative feedback); sample size n=107. *P<0.05, **P<0.01, ***P<0.00.

In order to test both hypotheses, this study used model 8 in the PROCESS procedure for simple mediation tests. Before testing, all variables were standardized (see Table 5). M4 in Table 5 shows the interaction term between creative time pressure and feedback valence had a significant positive effect on team relationship conflict ($b = 0.26$, $SE = 0.09$, 95% CI [0.0858, 0.4430]), which indicates that creative time pressure moderates the relationship between feedback valence and team relationship conflict. In order to better understand the pattern of interactions, we performed the Simple Slope test – the results are shown in Figures 2A and B. Feedback valence had a negative effect on team relationship conflict at low levels of creative time pressure ($b = -0.58$, $p < 0.001$), and had no significant effect on this conflict at high levels of pressure ($b = -0.05$, $p > 0.05$). M5 shows the interaction term between creative time pressure and feedback valence had a significant negative effect on team creativity ($b = -0.41$, $SE = 0.08$, 95% CI [-0.5664, -0.2444]), which indicates that creative time pressure moderates the relationship between feedback valence and team creativity. Specifically, feedback valence had a positive effect on team creativity at low levels of creative time pressure ($b = 0.78$, $p < 0.001$), and had no significant effect on team creativity at high levels of creative time pressure ($b = -0.14$, $p > 0.05$). On this basis, hypotheses 3 and 4 were accepted.

We calculated the moderated effect values and found differences in the mediated effect values for team relationship conflict for different levels of creative time pressure. The mediated effect value was 0.12 with $SE = 0.05$ at a 95% confidence interval [0.0306, 0.2500] for low levels of creative time stress; for high levels of creative time stress it was 0.01 with $SE = 0.03$ at a 95% confidence interval [-0.0499, 0.0720].

Discussion

Scholars have previously proposed that feedback potency impacts on creativity at the personal level,⁶ although their conclusions about the relationship between feedback potency and personal creativity are inconsistent. It is unlikely that it will be possible to identify how feedback potency affects team creativity by only referring to the individual level, as a unique team level perspective is required. Although some scholars have used an information processing perspective to study how the interaction between feedback potency and information diversity affects team creativity,⁵ few studies have drawn on other mechanisms to assess the impact of feedback valence on team creativity. This study engages at the team level to construct a conceptual model that can be used to assess how feedback potency affects creativity; in addition, it also uses a team relationship perspective to explore the mechanism of its influence on team creativity when it is subject to the regulation of creative time pressure.

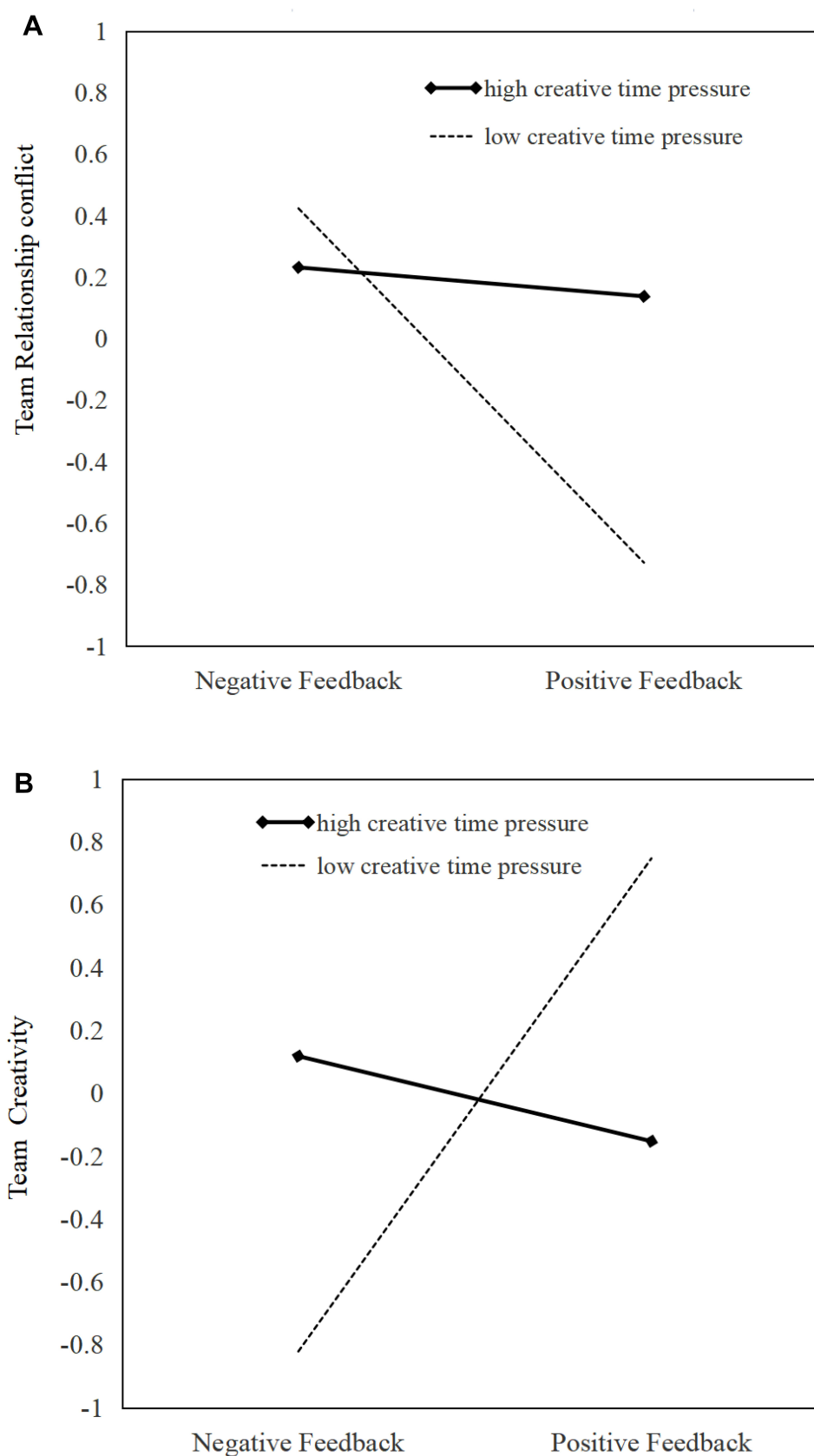


Figure 2 (A) Moderating effect of creative time pressure on feedback valence and team relationship conflict. **(B)** Moderating effect of creative time pressure on feedback valence and team creativity.

Notes: N=415. We standardized all focal variables to plot this graph. "High creative time pressure", "Low creative time pressure".

Theoretical Implications

This study enriches feedback interventions and relational identity theory, and makes three important theoretical contributions:

First, in referring to the creative time pressure context, it explores how the mechanism of feedback valence (positive and negative feedback), which is a widely used management tool, impacts on team creativity. This could potentially enrich research into feedback valence and team creativity. We began with the observation that most studies of the relationship between feedback valence and creativity engage at the individual level, and noted that this often meant that the team level was overlooked – this was confirmed by a review of the literature in China and other countries.

This study aims to explain how the influence of feedback value mechanism impacts team creativity, and it achieves this by adopting a conflict management perspective. This will enrich the study of feedback value in creative time pressure situations and will provide a new dimension to research that examines the influence of team creativity.

Second, in drawing on Relational Identity Theory, we propose to reveal how the mediating mechanism between feedback valence and team creativity operates in China, and seek to clarify how the micro-mechanism of feedback valence impacts team creativity. Although previous studies have also done this, they have insufficiently addressed the process mechanism, and accordingly this study proposes to examine how the conflict mechanism of the process mechanism of feedback valence impacts team creativity. In addition, it also establishes a clear path for the “feedback valence-team conflict-team creativity” relationship. It deepens the research into the influence of feedback valence on team creativity, expands knowledge of team conflict and enriches the literature on the relationship between team conflict and creativity.

Third, this study tests the moderating effect of creative time pressure in the “feedback valence-team conflict-team creativity” mechanism within a time-competitive context, and also further expands boundary conditions that affect the relationship between feedback valence and team creativity. This is one of the first studies to test the effect of creative time pressure in the field of feedback valence. It does not only verify the moderating effect of creative time pressure on the relationship between feedback valence and team creativity, but also constructs a mediating effect model and an empirical test that provides insight into the moderating mechanism of creative time pressure in the relationship between feedback valence and team creativity. It also adds creative time pressure as a key contextual weighting factor for performance outcomes. By emphasizing that both behavioral (feedback valence behavior) and situational factors (creative time pressure) contribute to team creativity, it provides a new theoretical perspective and explanation for the rational choice of feedback valence, which will enhance team creativity in a “fast-paced, highly innovative” real-world context.

Practical Contribution

This study explores the relationship between feedback valence, creative time pressure, team relationship conflict and team creativity, and its findings will be of direct interest to managers who are trying to improve team creativity.

First, this study finds that feedback valence has a significant impact on team creativity; that feedback from different valence produces distinct effects on team creativity; and that positive (as opposed to negative) feedback is more conducive to team creativity. These findings will be of direct interest to managers who are trying to improve team creativity. We propose that team leaders should seek to use positive feedback as a management tool in their team management to a greater extent. And, in doing so, we proceed from the premise that positive feedback is more beneficial in terms of improving team creativity. Efforts to improve the ability of managers to use feedback valence tools should include training related to feedback valence techniques and strategies, which will provide insight into which situation is most effective in terms of the use of positive feedback, and which methods and tools are most conducive to improved feedback efficacy. It is also anticipated the price effect will improve – as a result, managers will be able to more effectively apply feedback valence (a management tool) during their team creativity-related interventions, and this will in turn help managers and team members to develop high-quality feedback communication relationships, which will in turn contribute to improved team creativity.

Second, Chinese culture emphasises the importance of harmonious relationships, and this is why correct perceptions of team relationship conflict are extremely important. This, in addition to improved management practices, is clearly a precondition for the company’s development. Team relationship conflict is inevitable in a team and is also a key influence on team creativity. The findings show that team relationship conflict partially mediates the relationship between

feedback valence and team creativity. Positive feedback helps to reduce team relationship conflict, and this (indirectly) positively affects team creativity; negative feedback, meanwhile, increases team relationship conflict, which (indirectly) negatively affects team creativity. Managers should therefore have a full understanding of team relationship conflict; in addition, they should also initiate appropriate feedback valence interventions that establish a feedback intervention mechanism which reduces team relationship conflict and enhances team creativity.

Third, if employees have sufficient time to process feedback, this will improve team creativity. Companies that seek to more efficiently benefit from feedback valence will need to focus on creative time pressure. The managers of innovative companies believe that when there is great time pressure, team members will be stimulated, and they accordingly increase this pressure in the expectation that it will produce high levels of creativity. However, we show that when creative time pressure is strong, the (negative) effect of feedback valence on team relationship conflict will be weaker, and related reductions (in team relationship conflict) and enhancements (of team creativity) will be reduced. When creative time pressure is low, the (negative) impact of feedback on team conflict will be stronger, and so will the impact of team creativity on reduced team conflict. It is therefore important for managers to utilize the moderating effect of creative time pressure. If constraints inhibit a company's ability to reduce creative time pressure, then managers should increasingly use feedback valence interventions to reduce team conflict; this will reduce the amount of time that team members will commit to coordinating interpersonal relationships and will enable them to instead focus on resources that enhance information processing within the team; as a result, team creativity will be improved.

Limitations and Future Research

This study can still be improved in some respects. First, it used experimental methods to test hypotheses, which means it is not clear if its findings can be generalized to other situations. Second, its feedback valence was put in place while the task was in progress: this means it may not be possible to compare it to studies that consider how feedback valence on completed tasks affects team creativity in subsequent tasks. The teams we studied had relatively weak power distribution and temporal stability, and future research will need to engage teams that are more stable over time, as it is conceivable that previous history may influence team members' responses to feedback valence. Finally, our sample size was not sufficiently large, and the reliability and validity of the study results could have been improved had it been larger. Future longitudinal studies with multiple time points could also provide insight into how other mechanisms of the effect of feedback valence impact team creativity. They also provide insight into the antecedent variables of feedback valence and the affect of feedback valence on employees' feedback-seeking behavior. These contributions will produce active employees, and this will in turn enhance creativity and innovation performance.

Conclusions

This study constructs a conceptual model that examines how feedback valence affects creativity at the team level, and it explores the mechanism through which it affects team creativity. It does this by using a team relationship conflict perspective to consider creative time pressure regulation. After undertaking theoretical and empirical analyses, it verifies most of the hypotheses and draws some important conclusions and findings, which follow:

1. Feedback valence positively affects team creativity.
2. Positive feedback (as opposed to its negative counterpart) is more conducive to enhanced team creativity.
3. Positive feedback also helps to reduce team relationship conflict, which (indirectly) positively affects team creativity;
4. Negative feedback increases team relationship conflict, which (indirectly) negatively affects team creativity;
5. Team relationship conflict partially mediates the relationship between feedback valence and team creativity.
6. Creative time pressure moderates the relationship between feedback valence and team creativity. When it is low, the positive effect of feedback valence on team creativity is higher; when it is high, the positive effect of feedback valence on team creativity is lower. It also moderates the relationship between feedback valence and team conflict. When it is low, feedback valence has a stronger (negative) effect on team relationship conflict; when the converse applies, feedback valence has a weaker (negative) effect on team relationship conflict.

Data Sharing Statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Institutional Review Board Statement

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board of Zhejiang Gongshang University and Zhejiang College of Security Technology.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

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The authors declare no conflict of interest.

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