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ORIGINAL PAPER

How to avoid collapse after one setback: developmental feedback alleviates the spillover negative impact of competence frustration

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Abstract

Prior research has primarily focused on the negative effects of sustained autonomy frustration and relatedness frustration on subsequent tasks. However, there is a relative scarcity of studies examining the detrimental effects of consistent competence frustration on following tasks using event-related potentials (ERPs). To explore the spillover effect of consistent competence frustration and to identify intervention strategies aimed at mitigating its adverse consequences, we designed a three-session electroencephalography(EEG) group experiment. Participants were randomly assigned to one of three groups: a control group, a competence frustration group, and a developmental feedback group. All participants were instructed to work on the time-estimation (TE) task during sessions 1 and 2, followed by the stopwatch (SW) task in session 3. The primary distinction between the control group and the competence frustration group lay in task difficulty. Specifically, participants in the control group completed a moderately difficult TE task during sessions 1 and 2, whereas those in the competence frustration group were instructed to accomplish a highly difficult TE task that was intended to induce competence frustration. The only difference between the competence frustration group and the developmental feedback group was that participants in the developmental feedback group received developmental feedback about their performances at the end of sessions 1 and 2, while those in the competence frustration group received only standard performance feedback. In session 3, we observed a less pronounced reward positivity (RewP) difference wave upon receiving feedback in the competence frustration group compared to that observed in the control group. This finding suggests that consistent competence frustration may diminish one's motivation in subsequent tasks. Moreover, in session 3, the amplitude of RewP difference wave was larger in the developmental feedback group than in the competence frustration group. This indicates that developmental feedback may alleviate the negative effects of consistent competence frustration on following tasks.

Keywords Competence frustration · Developmental feedback · Motivation · Self-determination theory · Event-related potentials · Reward positivity

Introduction

Competence is a fundamental element of human motivation, experienced when individuals feel effective, perceive mastery over their environment, and are capable of acquiring new skills (Harter & Bukowski, 2012; Ryan, 2023). According to self-determination theory (SDT), competence constitutes one of the three basic psychological needs that are essential for psychological development and well-being (Deci & Ryan, 2000). It is widely acknowledged that competence satisfaction is positively correlated with work motivation, job satisfaction, and overall well-being (Van den Broeck et al., 2016). However, employees may experience competence frustration when confronted with overwhelming challenges, negative feedback, or high levels of job

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uncertainty (Ryan & Deci, 2017). Competence frustration encompasses feelings of inadequacy or failure as well as self-doubt (Bartholomew et al., 2010).

In a need-threat mode based on SDT theory, the reaction to need frustration evolves over time (Radel et al., 2011). After experiencing transient need frustration, individuals activate recovery mechanisms, leading them to focus more intently on thwarted needs and exhibit heightened motivation in subsequent tasks (Fang et al., 2018; Radel et al., 2011). Conversely, when consistently facing need frustration, individuals may resort to compensatory strategies such as seeking substitutes for their unmet needs, focusing more on external goals, relaxing self-control, and developing negative behaviors (Vansteenkiste & Ryan, 2013). Specifically, persistent competence frustration refers to the ongoing experience of feeling deprived of competence (Radel et al., 2011), which often results in negative outcomes including counterproductive work behavior, diminished work engagement, and reduced intrinsic motivation (Bartholomew et al., 2014). However, there has been limited research investigating the spillover effect of consistent competence frustration on subsequent tasks through experimental methods. Consequently, the primary objective of this study is to explore whether the negative consequences of ongoing competence frustration extend to later tasks using an experimental approach.

In addition, SDT posits that an organization's situational conditions and individual characteristics significantly influence the satisfaction of individuals' fundamental psychological needs. Previous research has demonstrated that situational factors such as job autonomy, perceived organizational support, leadership behaviors and attitudes can impact employees' competence satisfaction (Van den Broeck et al., 2016). Specifically, servant leadership is positively related to competence because servant leaders create the necessary conditions for employees to advance their careers, encourage them to assume responsibility, and provide timely developmental feedback, all of which are beneficial for enhancing one's competence (Liden et al., 2008). Moreover, individual characteristics such as emotional stability, resilience, and perfectionism may mitigate the adverse effects of competence frustration on subsequent tasks (Aarts, 2009; Fang et al., 2018; Fiske, 2004). However, there is a scarcity of studies that have investigated intervention strategies for competence frustration from an organizational perspective using experimental methods. Consequently, this study aims to identify organizational-level intervention measures to mitigate the negative effects of persistent competence frustration.

Following transient competence frustration, individuals tend to pay increased attention to competence-related stimuli in subsequent tasks and are more eager to restore their sense of competence (Waterschoot et al., 2019). This study inspired us to explore interventions aimed at enhancing one's sense of competence as a means of addressing frustration. Developmental feedback refers to the extent to which supervisors provide their employees with constructive information that facilitates learning, development, and improvement in job performance (Zhou, 2003). According to SDT, competence satisfaction emphasizes employees' job competence, enhancement of work abilities, and external recognition of their abilities (Deci & Ryan, 2000). Developmental feedback serves as an encouraging form of feedback designed to fulfill the competence of employees under various conditions. On one hand, it offers encouragement and acknowledgment of employees capabilities while also providing effective resources and guidance for their work (An et al., 2021). This support enables employees to streamline their workflow and gain a clear understanding of their tasks. On the other hand, it empowers employees by supplying valuable resources and opportunities for knowledge enhancement and skill development (Wang & Zhang, 2022). Such support enables employees to overcome work challenges and address any areas of weakness. Consequently, they are better equipped to creatively perform their duties, improve their abilities, and fulfill their need for competence (Zhang et al., 2023). After suffering persistent competence frustration, if superiors promptly provide developmental feedback, employees may receive crucial support from leaders, which may encourage them to try new things without fear of failure and then result in a high level of intrinsic motivation (Guo et al., 2014). In light of this context, our study aims to examine whether developmental feedback can alleviate the negative effect of consistent competence frustration on employee motivation in subsequent tasks.

The goal of this study is to investigate the spillover effect of consistent competence frustration on subsequent tasks and to identify potential intervention strategies. To achieve this, we designed a three-session between-group electroencephalography(EEG) experiment. Participants were randomly assigned to one of three groups: the control group, the competence frustration group, or the developmental feedback group. Each participant attended all three sessions and was instructed to complete a time-estimation (TE) task during sessions 1 and 2, followed by a stopwatch (SW) task in session 3. Specifically, during sessions 1–2, subjects in the control group completed a moderately difficult TE task, while those in both the competence frustration group and the developmental feedback group were instructed to complete a highly difficult TE task that was intended to induce competence frustration. In addition, all participants received standard performance feedback after each trial, while those only in the developmental feedback group received supplementary developmental feedback at

the end of sessions 1 and 2. In session 3, all participants worked on the SW task with medium difficulty (Ma et al., 2017; Meng et al., 2016). To examine the spillover effect of consistent competence frustration on one's motivation in a subsequent task, we compared one's motivation to win in the SW task between participants from the control group and those from the competence frustration group. Moreover, to investigate whether developmental feedback would alleviate the negative impact of consistent competence frustration, we analyzed one's motivation to win in the SW task between the developmental feedback group and the competence frustration group. Event-related potentials (ERPs) technique allows us to observe cognitive processing within the brain by collecting electrophysiological signals as well as potential changes occurring on its surface. The primary advantage of ERPs technology lies in its exceptional temporal accuracy, which can be precise to the millisecond level. Considering that ERPs technology can achieve objective, real-time and accurate measurement of one's motivation during task engagement, we employed EEG to assess one's motivation. Specifically, the magnitude of reward positively (RewP) was used as a candidate measure to evaluate the level of one's motivation.

The RewP refers to a positive-going event-related potential component, which is most pronounced at frontal-central electrodes, often reaching its peak magnitude around 250–300 ms upon feedback (San Martin, 2012). It is more pronounced for the positive outcomes compared with the negative ones (Muhlberger et al., 2017; Proudfit, 2015). Based on the motivational significance theory of RewP, its amplitude reflects the motivational and/or affective significance of outcomes (Masaki et al., 2006; Yeung et al., 2005). To eliminate the potential influence of individual differences in the baseline RewP magnitude, most studies examining the RewP have employed a difference wave approach. The difference wave of RewP (the amplitude of RewP in response to wins minus that elicited by failures) represents a quick subjective assessment of the outcome's motivational significance (Gehring & Willoughby, 2002; Yeung et al., 2005). Previous research has indicated that a more pronounced RewP difference wave is associated with greater perceived motivational significance (Masaki et al., 2006; Meng & Ma, 2015; Wei et al., 2020). A series of studies consistently demonstrate that the amplitudes of the difference wave RewP are correlated with one's motivation (Fang et al., 2018; Ma et al., 2014; Meng & Ma, 2015). Following the pioneering literature, we resorted to the difference wave RewP as a potential measure to assess one's motivation in session 3. We hypothesized that continuous competence frustration would spill over to the subsequent irrelevant activity, and the developmental feedback would alleviate the negative effects of continuous competence frustration on the following task. We proposed the following hypotheses:

Hypothesis 1 *Compared with the control group, participants in the competence frustration group are expected to exhibit a decreased motivation to win, as indicated by a less pronounced RewP difference in the following competence-supportive task.*

Hypothesis 2 *In comparison to the competence frustration group, individuals in the developmental feedback group are anticipated to demonstrate an increased motivation to win, as reflected by a more pronounced RewP difference in the subsequent competence-supportive task.*

Methods and materials

Participants

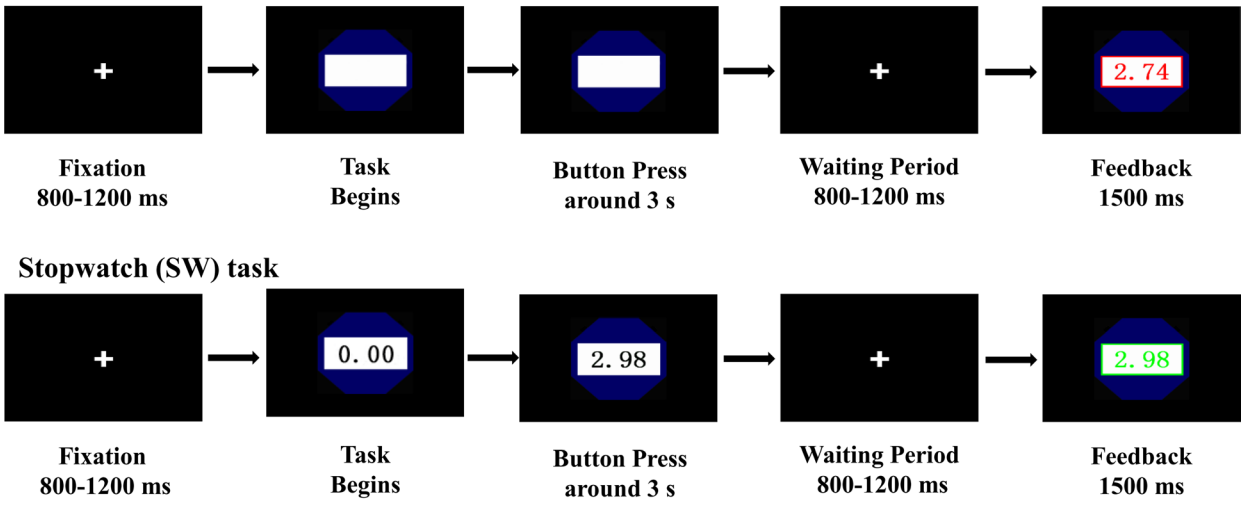
The study was approved by the local Internal Review Board. 75 healthy right-handed participants from a Chinese university were recruited in the current study. They were between the ages of 19 and 23 years ($M = 20.70$, $SD = 0.98$). We conducted a power analysis to determine the sample size before the formal experiment, in which we assumed the effect size (f) to be 0.4 and the error probability (α) to be 0.05. The recommended sample size was found to be 54, which our final sample met.

Participants were randomly assigned to one of three groups: the control group ($N = 25$, 13 females), the competence frustration group ($N = 25$, 13 females), and the developmental feedback group ($N = 25$, 12 females). They all reported either normal or corrected-to-normal vision, and none had a history of neurological or mental illnesses. We got each participant's written informed consent prior to the formal experiment. Three participants with excessive artifacts were excluded from analysis, retaining 72 participants (36 females; 23 in the control group; 24 in the competence frustration group; 25 in the developmental feedback group) for subsequent analyses.

Experimental paradigms

Participants were seated in quiet, sound-dampening, and electrically shielded apartments that were dimly lit. All experimental stimuli were presented to participants at a distance of 100 cm from the center of a computer screen, with a visual angle ranging from 6.2° to 5.4°. Throughout the experiment, participants were instructed to use a keypad to accomplish various tasks. As depicted in Fig. 1B, the experiment consisted of 3 sessions, there were 40 trials in

A



B

Group	Session 1	Session 2	Session 3
Control group	40 trials of the TE task (medium difficulty)	40 trials of the TE task (medium difficulty)	60 trials of the SW task (medium difficulty)
Competence frustration group	40 trials of the TE task (high difficulty)	40 trials of the TE task (high difficulty)	60 trials of the SW task (medium difficulty)
Developmental feedback group	40 trials of the TE task (high difficulty)	40 trials of the TE task (high difficulty)	60 trials of the SW task (medium difficulty)

Fig. 1 Illustration of the experimental paradigm. (**A**) Procedure for the time-estimation (TE) task and the stopwatch (SW) task; (**B**) Overall experimental procedure.

sessions 1 and 2, and 60 trials in session 3. During sessions 1 and 2, participants from the competence frustration group and the developmental feedback group were required to accomplish a highly difficult TE task. Specifically, the success interval for this highly difficult TE task is [2.93 s, 3.07 s], and the success rates are around 15% (Fang et al., 2018). In contrast, participants in the control group engaged with a medium-difficulty TE task during these same sessions, and this task had a success interval of [2.75 s, 3.25 s]. Following that, all participants were required to complete a SW task of moderate difficulty (the success interval of which is [2.93 s, 3.07 s]) in session 3. As suggested in previous studies, the task with moderate difficulty is competence-supportive. Moreover, both moderate difficulty TE tasks and moderate difficulty SW tasks resulted in approximate success rates of around 50% for participants, respectively (Fang et al., 2018). All the defined success time windows were consistent with the existing research (Fang et al., 2018), wherein we conducted a pilot study to determine the appropriate time windows. To prevent any potential confusion, we only informed the participants that the entire experiment consisted of 3 distinct sessions at the beginning.

All participants received a fixed ¥40 as compensation for their participation in this study. Prior to each session, participants were instructed to review the relevant instructions and complete several practice trials in order to familiarize themselves with the task. The stimuli were displayed using the E-Prime 2.0 program from Psychology Software Tools in Pittsburgh, PA, USA. Triggers and behavioral reactions were also recorded throughout the experiment. By the end of the experiment, we measured participants' competence frustration using the basic psychological need satisfaction and frustration scale within a work domain (Chen et al., 2015; Schultz et al., 2015), which comprised 4 items (e.g., "I feel disappointed with my performance in the time-estimation game"). All terms exhibited good internal consistency (α= 0.763). Finally, a debriefing and compensation were given to the participants.

The time-estimation (TE) task

For the TE task, all participants were instructed to estimate a time duration of 3 s, and the closer the estimate to the target, the better (Wei et al., 2020). During the first 800–1200 ms of each trial, a cross icon was shown, as illustrated in Fig. 1A. Subsequently, a stopwatch pattern emerged, signaling the beginning of the time estimation. Participants can press any single key on the keypad immediately if they think that 3 s have passed. After the response, a cross icon was displayed once more for 800–1200 ms. Then the specific stop time (feedback information) would be displayed for 1500 ms. The stop time would be displayed in green if the reaction dropped in the appointed success time range. If not, it would be highlighted in red. Finally, there was a random blank interval lasting between 600 and 1000 ms before initiating the subsequent trial.

The stopwatch (SW) task

For the SW game, the participants were asked to stop a running watch at approximately 3 s. Similarly, the closer, the better. The SW task is highly similar to the TE task (Ma et al., 2014), and only one difference is that there exists a running stopwatch in the SW task. As displayed in Fig. 1 A, a cross icon was initially presented for 800–1200 ms for each trial. After then, a stopwatch icon would appear and begin to run automatically. Participants were directed to stop it as soon as it reached 3 s. The feedback pattern of the SW task was consistent with that of the TE task.

Experimental manipulation

Consistent with previous studies (Fang et al., 2018), we adopted a high difficulty task to elicit competence frustration in both the competence frustration group and the developmental feedback group, where participants' success rates were approximately 15%. Previous studies have indicated that developmental feedback, which refers to giving subordinates some valuable and helpful feedback, can increase one's competence and autonomous motivation (Chiviacowsky & Wulf, 2002; Zhou, 2003). Consequently, at the end of sessions 1 and 2, we provided developmental feedback with participants in the developmental feedback group. To be specific, the planned brief message was, "Dear student, your success rate is at a medium level. The main reason is that you are a little nervous, and the key gestures are not entirely accurate. In the upcoming experiment, please remember to relax, adjust your sitting posture, and keep your fingers close to the keys. I believe you will have better performance." Participants in both the control group and competence frustration group just received standard performance feedback.

EEG data recordings and analyses

An eego amplifier and a Waveguard EEG Cap (manufactured by ANT Neuro, Enschede, Netherlands) with 64 Ag/AgCl electrodes were used to record EEG data. After going through an online band-pass filter that operated between 0.1 and 100 Hz, the channel data was collected at a sampling rate of 500 Hz. The EEG experiment would start when all electrode impedance were lowered to below 10 kΩ and remained stable. The left mastoid served as the online reference throughout the experiment, and the average value of the left and right mastoids was computed for offline re-referencing.

The ASALab 4.10.1 software package (ANT Neuro, Enschede, Netherlands) was employed for the offline analysis of EEG data. The following pre-processing steps were implemented: (a) a digital low-pass filter set to 30 Hz (24 dB/octave); (b) the algorithm built into the ASALab software for the identification and gathering of ocular artifacts; (c) segmentation of −200/+800 ms surrounding the start of the feedback stimuli; (d) baseline correction, where the waveform from −200 ms to the start of the feedback stimulus served as the baseline; (e) artifact detection eliminated trials containing amplifier clippings, bursts of electromyography activity, or peak-to-peak deflections above ±100 μV from the final within-subject average.

The main focus of the present research was on the RewP, which has been demonstrated to be closely associated with outcome appraisal and feedback processing (Cockburn & Holroyd, 2017). The mean voltage within the time window of 280–330 ms was analyzed based on visual inspection of the globally averaged waveforms, as well as findings from prior studies. The fronto-central electrodes Fz, Fcz and Cz have been shown in previous studies to exhibit the highest level of the RewP, which is likewise the case in the present investigation (Fernandes et al., 2018; Oemisch et al., 2017). In this study, we selected an electrode cluster comprising F1, Fz, F2, FC1, FCz, and FC2 for RewP analysis. This decision was made because treating individual electrodes as separate factors during statistical analyses is not advisable (Luck & Gaspelin, 2017). The mean amplitude of RewP within this cluster was calculated before conducting repeated measures ANOVA. Statistical analyses were carried out with the IBM Statistical Package of Social Science (IBM SPSS Version 25).

Results

Manipulation check

The one-way repeated-measure ANOVA revealed a significant main effect of the three groups on competence frustration, $F_{2, 69}$ = 3.748, p= 0.028, η^2= 0.098. Subsequent pairwise comparison indicated that participants in the competence frustration group (M= 3.938, SD= 1.142, p= 0.031) and the development feedback group (M= 4.045, SD= 1.357, p= 0.014) experienced a higher level of competence frustration compared to those in the control group (M= 3.141, SD= 1.196). However, there were no significant differences in the sense of competence frustration between the competence frustration group and the development feedback group (p= 0.762) when working on the TE task during sessions 1 and 2. These findings indicated that our manipulation was successful.

Task performances

The ANOVA analysis showed no significant main effect of the three groups on success rates, $F_{2, 69}$ = 0.963, p= 0.387, η^2= 0.027. Subsequent pairwise comparisons indicated that the contrast between the competence frustration group (M= 0.532, SD= 0.118) and the control group (M= 0.486, SD= 0.107, p= 0.183), as well as that between the competence frustration group and the development feedback group (M= 0.519, SD= 0.127, p= 0.710), in success rates during session 3 was not significant.

ERP results

The grand averaged waveforms in the electrode cluster are displayed in Fig. 2A. The mean RewP amplitudes under different experimental conditions were 5.286 μV (developmental feedback group-win) and 2.303 μV (developmental feedback group-lose), 2.217 μV (competence frustration group-win) and 0.960 μV (competition frustration group-lose), 10.922 μV (control group-win) and 7.906 μV (control group-lose). ANOVA results of the RewP showed a significant main effect of outcome ($F_{2, 69}$ = 64.241; p< 0.001; η^2= 0.482) and group ($F_{2, 69}$ = 21.657; p< 0.001; η^2= 0.386). The main effect of outcome indicated that there was a more positive RewP in the winning condition (6.142 μV) than in the losing condition (3.723 μV).

Furthermore, a significant interaction effect was observed between group and outcome ($F_{2, 69}$ = 3.704; p= 0.030; η^2= 0.097). In particular, the amplitude of the difference wave RewP was less pronounced in the competence frustration group (1.258 μV) compared to the control group (3.016 μV). Additionally, the difference wave of RewP was significantly larger in the development feedback group (2.984 μV) than in the competence frustration group (1.258 μV). Moreover, there was no significant difference in the amplitude of the difference wave RewP between the control group and the development feedback group (t (46) =0.038, p= 0.969, Cohen' s d= 0.011). Subsequent simple effect analyses showed that RewP amplitude was more pronounced in winning conditions than losing ones across all groups: competence frustration group ($F_{1, 69}$ = 5.795; p< 0.05; η^2= 0.077), the development feedback group ($F_{1, 69}$ = 33.971; p< 0.001; η^2= 0.330) and the control group ($F_{1, 69}$ = 31.934; p< 0.001; η^2= 0.316). Meanwhile, in the winning condition, a significant difference in RewP amplitude was observed among the groups ($F_{2, 69}$ = 18.457; p< 0.001; η^2= 0.349). Similarly, in the losing condition, there was also a notable difference in RewP amplitude among the groups ($F_{2, 69}$ = 21.483; p< 0.001; η^2= 0.384).

The results of the correlation analyses indicated that task difficulty during sessions 1–2 was positively correlated with competence frustration (r= 0.311, p< 0.01), but the association between competence frustration and difference wave RewP is not significant (r= 0.062, p= 0.606). Furthermore, we employed the bootstrap method to test the mediation effect of competence frustration in the relationship between task difficulty and the amplitude of the difference wave RewP (Bootstrap sample =5000, CI= 95%). Results showed that the mediation effect included 0 ($LLCI$= − 0.504, $ULCI$= 0.374), indicating that the mediating effect of competence frustration is not significant.

Discussion

In order to investigate the spillover effect of competence frustration on subsequent tasks and to explore potential intervention strategies, we designed a three-session EEG experiment. Participants were randomly allocated to one of three groups, all of whom were instructed to work on the TE task during sessions 1 and 2, followed by the SW task in session 3. The primary difference between the control group and the competence frustration group lay in the task difficulty. Specifically, in the control group, participants completed a moderately difficult TE task during sessions 1 and 2, whereas those in the competence frustration group were instructed to accomplish a highly difficult TE task. The only distinction between the competence frustration group and the developmental feedback group was that participants in the developmental feedback received additional developmental feedback about their performances at the end of sessions 1 and 2, while those in the competence frustration group received only standard performance feedback. As expected, compared with the control group, we observed a

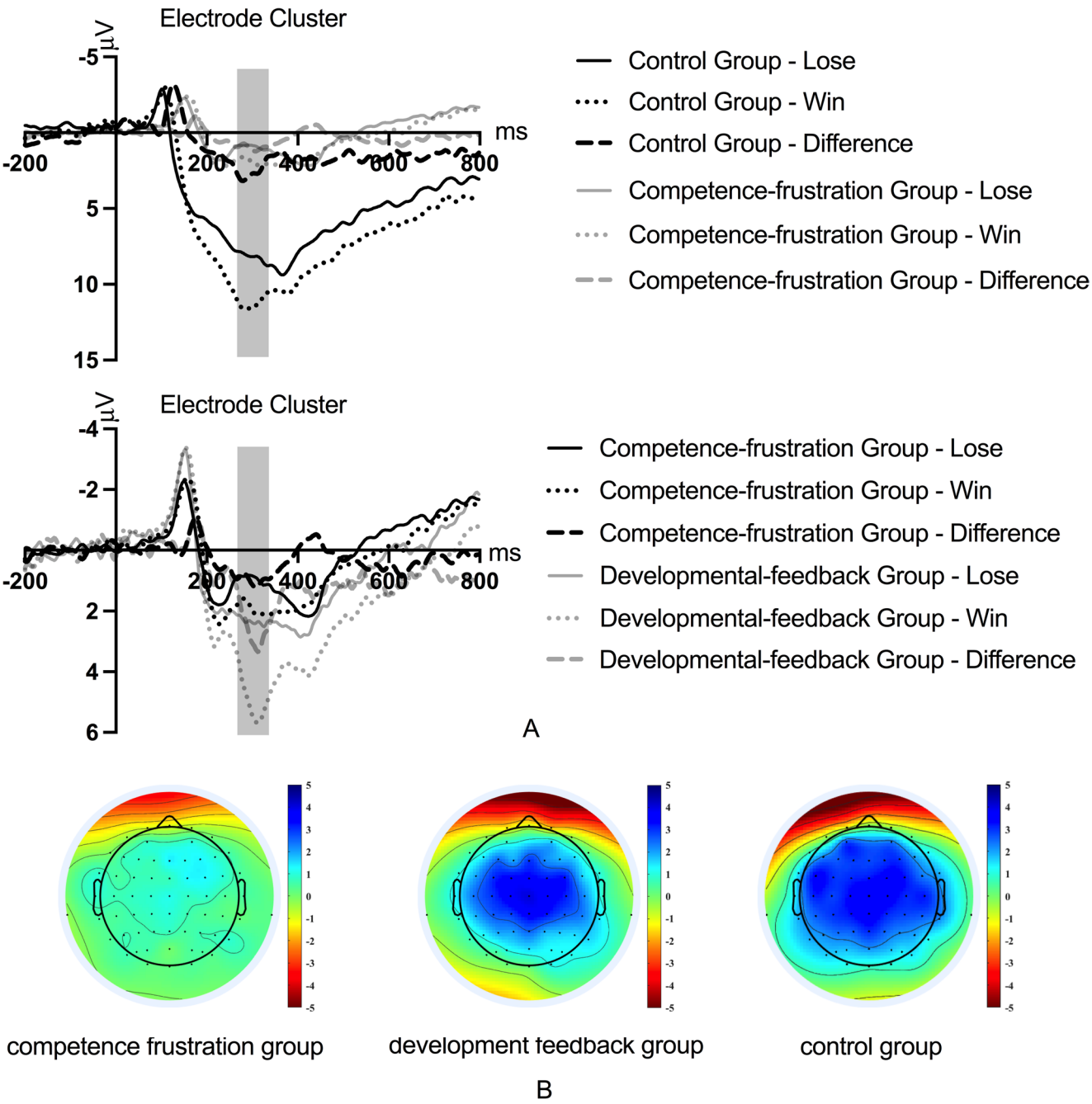


Fig. 2 ERPs results. **A** The grand averaged waveform of RewP. **B** The topographic distributions of the difference wave are plotted for all groups.

less pronounced RewP difference wave upon feedback in the following SW task in the competence frustration group. Based on the cognitive implication of Rewp, the difference wave of RewP can reflect a fast subjective appraisal of the outcome's motivational significance (Gehring & Willoughby, 2002; Yeung et al., 2005). Moreover, a series of EEG studies have suggested that the amplitude of the RewP difference is associated with one's motivation (Fang et al., 2019; Meng & Ma, 2015). Accordingly, these results suggest that consistent competence frustration may exert a long-term negative influence by reducing one's motivation in the following competence-supportive activity. Additionally, in the subsequent SW task, we found that the amplitude of RewP difference wave was larger in the developmental feedback group than those in the competence frustration group. According to the motivational significance theory, these findings imply that participants in the developmental feedback group have higher motivation to win in the following task compared with ones in the competence frustration group. Thus, our results indicate that developmental

feedback may alleviate this negative spillover effect of consistent competence frustration.

Previous research has demonstrated that long-term autonomy frustration may lead children to focus on external goals and engage in harmful behaviors such as smoking or alcohol abuse (Williams et al., 2000). Individuals who experience sustained relatedness frustration may exhibit increased aggression (Twenge et al., 2001), develop a dislike for intimate relationships (Moller et al., 2010), pursue external goals such as wealth and status (Deci & Ryan, 2000), and become less altruistic (Twenge et al., 2007). Consistent with these prior studies, our research also indicates that the negative impact of sustained competence frustration can spread to subsequent tasks, resulting in individuals giving up their pursuit of competence and demonstrating lower motivation in subsequent tasks. Additionally, our findings suggest that developmental feedback can alleviate the negative impact of consistent competence frustration on one's motivation in a subsequent task. This may be attributed to the fact that individuals who follow consistent competence frustration are more inclined to concentrate on competence-related stimuli in subsequent tasks, demonstrating a strong desire to restore their sense of competence (Waterschoot et al., 2019). Developmental feedback is encouraging and helpful feedback that can meet employees' need for competence. Specifically, it gives participants encouragement in their work, recognizes their ability, and provides effective work resources (An et al., 2021). Previous studies have suggested that competence satisfaction facilitates motivation (Deci & Ryan, 2000). Along similar lines, in the current study, the presented developmental feedback affirmed participants' task performance and provided effective guidance to help them improve task performance in the following activity. As a result, it enhanced competence satisfaction in the subsequent task, which may increase one's motivation in the following task.

Our findings indicate that competence frustration does not exhibit a significant correlation with an individual's motivation. However, prior research has shown that competence frustration is often associated with negative outcomes, including turnover intentions (Gillet et al., 2015), disengagement (Jang et al., 2016), and reduced motivation (Earl et al., 2017; Fang et al., 2017). This inconsistency may arise from the limitations of self-report scales in assessing competence frustration, as these scales often lack reliability and may fail to capture certain dimensions of this construct. Moreover, competence frustration is an internal psychological response that poses significant challenges for accurate measurement using traditional methods. In contrast, the ERP method can capture real-time dynamic activity in the cerebral cortex, thereby providing an objective reflection of an individual's psychological and cognitive states. This highlights the potential of ERP as a novel approach for assessing competence frustration. Therefore, the findings of this study support the use of ERP methods in future research to provide a more comprehensive understanding of competence frustration.

Moreover, the mediating effect of competence frustration on the relationship between task difficulty and difference wave RewP was not significant. This lack of significance may be attributed to three potential factors. First, our sample size was relatively limited. Mediation effect analysis generally demands a sufficiently large sample size to ensure robust and reliable results. Second, self-report measures primarily focus on the conscious and reflective aspects of competence frustration, which might not fully capture its multidimensional nature. Third, while the RewP difference wave measured using ERP techniques indexes more implicit or automatic motivational responses, it may fail to account for other components of motivation that are not directly reflected in this neural measure. Therefore, the findings of this study indicate that not all motivational components can be adequately captured by ERP components alone. Future research should integrate ERP experiments with self-reporting methods to provide a more comprehensive assessment of an individual's motivation.

Implications for theory

The current research expands upon the existing literature on competence frustration and motivation, offering new insights for self-determination theory by investigating the negative impact of sustained competence frustration on a subsequent task. Prior research has mainly focused on the negative effects of sustained autonomy frustration and relatedness frustration on subsequent tasks. However, less research has examined the negative impact of sustained competence frustration on subsequent tasks. Our findings confirm the spillover effect of competence frustration on following tasks. Individuals who experience continuous competence frustration are likely to give up their pursuit of competence in the subsequent task, resulting in diminished motivation.

The results also suggest that developmental feedback can alleviate the negative impact of persistent competence frustration on one's motivation in subsequent tasks, which enriches the literature on developmental feedback. Previous studies have demonstrated that individual characteristics such as emotional stability, resilience, and perfectionism can reduce the negative impact of competence frustration on subsequent tasks (Aarts, 2009; Fang et al., 2018; Fiske, 2004). However, there is a scarcity of studies that have investigated intervention strategies aimed at addressing competence frustration within organizational

contexts. Previous research has indicated that developmental feedback serves as a beneficial form of feedback, which is positively associated with one's competence satisfaction, intrinsic motivation, and job performance (Guo et al., 2014; Guo et al., 2023; Zhang et al., 2023). Specifically, when leaders provide timely developmental feedback during instances of employee competence frustration, employees are likely to perceive this support from their leaders. This perception encourages them to explore new methods without fear of failure and enhances their intrinsic motivation for subsequent tasks (Guo et al., 2014). Furthermore, our study reveals that developmental feedback mitigates the negative effect of sustained competence frustration on one's motivation in the following task. This effect might be attributed to the fact that the provision of performance recognition and task guidance through the developmental feedback offered in our study. Consequently, this enhances participants' sense of competence and boosts their motivation to engage in future tasks.

Implications for practice

The current research carries significant practical implications. Firstly, our findings reveal that the negative effects of sustained competence frustration may extend to subsequent tasks. Competence is a fundamental psychological need, employees are likely to strive to restore their sense of competence following competence frustration. However, when individuals face continuous competence frustration, they may give up their pursuit of competence and reduce their motivation to engage in subsequent tasks. Consequently, it is imperative for enterprise managers to prioritize the enhancement of employees' competence. Managers should create opportunities that assist competence-frustrated employees in regaining their sense of competence, thereby enhancing their overall happiness and promoting higher levels of motivation. Secondly, our study provides managers with effective strategies to scientifically address competence frustration. We found that developmental feedback can alleviate the negative impact of continuous competence frustration on subsequent tasks. Employees are likely to encounter competence frustration in the workplace. However, managers can mitigate the adverse effects of persistent competence frustration by offering timely developmental feedback.

Limitation and future directions

This study has several limitations that should be discussed and addressed by future research. First, to avoid making our research aim explicit to the participants, we did not require them to rate their motivation during Session 3. While the collection of self-reported data on motivation could have offered supplementary support for the electrophysiological findings, we chose to forgo this approach. Second, as indicated by previous research, individuals with varying personality traits (i.e., causality orientation) may exhibit different cognitive and behavioral responses to needs frustration (Fang et al., 2018, 2019). While our findings suggest that developmental feedback can influence the spillover effect of competence frustration, it is essential to further investigate individual difference factors. Third, competence frustration represents an internal psychological response that poses substantial challenges for accurate measurement using traditional methods. Therefore, future research is encouraged to incorporate the event-related potential (ERP) approach as a complementary tool to achieve more precise measurement of competence frustration. Finally, while the amplitude of the RewP difference wave may partially reflect an individual's motivation level, the nature of human motivation is inherently complex, multidimensional, and dynamic. Thus, future research should integrate multiple methodologies to provide a more comprehensive assessment of motivation and effectively replicate these effects.

Conclusion

The present study aims to explore the spillover effect of competence frustration on subsequent tasks and to identify potential intervention strategies. Electrophysiological data indicate that following consistent competence frustration, participants exhibited decreased motivation (as reflected in the magnitude of RewP difference wave) in a subsequent activity. Furthermore, our findings suggest that developmental feedback from leaders can alleviate the detrimental spillover effects of persistent competence frustration. Consequently, this study adds to the expanding body of literature on competence frustration and offers significant practical implications.

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Data availability The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Conflict of interest The authors state that there is no conflict of interest.

Ethical approval This study was reviewed and authorized by the local institutional review board. All subjects provided written informed consent before the formal experiment.

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