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The influence of empathy on the interpersonal emotion regulation strategies of adolescents

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The aim of this study was to explore the use of interpersonal emotion regulation (IER, other-focused emotion regulation through social means) strategies among high school students in relation to empathy. At the core of empathy is a cognitive process of understanding another's thoughts and emotions (cognitive empathy) and an emotional component of sharing another's emotional experience (affective empathy). In Study 1, the Emotion Regulation of Others and Self questionnaire was used to investigate the current status of IER strategies most common among 414 high school students from Beijing and Jinan, China. In Study 2, a co-operative scenario was created to identify the IER strategies employed by a cohort of 128 students selected from Study 1 with varying levels of empathy in response to different levels of interpersonal intimacy. The results indicate that students with high levels of cognitive empathy and low levels of affective empathy were more likely to use affect-improving strategies, whereas those with low levels of cognitive empathy and high levels of affective empathy were more inclined to use affect-worsening strategies. Overall, the choice of IER strategies is influenced by interpersonal motivation to regulate emotions.

Keywords Interpersonal emotion regulation strategies, Cognitive empathy, Affective empathy, Interpersonal intimacy

William, the captain of the high school basketball team, noticed that the star player, Jack, seemed low in emotion as the time of a crucial game was approaching that could earn the team members an official bid for college admission. In addition, William discovered that Jack had just experienced a devastating family tragedy and knows that more angry emotions can drive players to perform better. With the game only 5 min away, should William exploit the anger of Jack to achieve a *bonus* or offer comfort to *boost* his emotions?

Interpersonal emotion regulation (IER) strategies among adolescents

In this situation, William engages in the dilemma of selecting an interpersonal emotion regulation (IER) strategy, a conscious process of a regulator to intentionally alter the emotional states of another using various strategies and techniques to achieve emotional management and facilitate social interactions[1]. This issue is not only limited to challenges in basketball competitions but also reflects a broader problem among adolescents. Many adolescents experience psychological distress during interpersonal interactions, which can manifest as difficulties in communication, strained social relationships, and even lead to depression. IER strategies can be strategic cognitive or behavioral efforts, driven by varying objectives, such as hedonistic, relational, and instrumental goals[2]. The mode of intervention corresponds to two IER strategies: affect-worsening, which refers to worsening other's feelings, and affect-improving, which refers to improving other's emotions[3,4]. For example, if a close friend mentions receiving a promotion at work, an affect-improving strategy could be employed to offer sincere praise, thereby greatly improving the emotions and affective experience of the friend. However, according to Zaki, if a close friend confides to another about a struggle with alcoholism, an affect-worsening strategy could be employed to worsen the emotional experience of the friend by discussing the dangers of alcohol abuse to instill fear and promote abstinence. Thus, both strategies ultimately aim to increase the well-being of others[5,6].

The ability to regulate emotions, especially in interpersonal interactions, is crucial to establish and maintain adolescents' healthy interpersonal relationships[7,8]. Upon entering high school, adolescents experience significant development in emotional regulation and social skills, with the opportunity for interpersonal emotion regulation occurring frequently, which amplify the need for social belonging and identity[9]. In fact, high school students who

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are adept at using IER strategies to cope with emotional challenges are reportedly able to express emotions more clearly and have stronger social skills with better social connections and interpersonal adjustments[10–13]. The effectiveness of these strategies depends on the interplay between individual's characteristics and relationship factors as well as situational factors, which are yet to be understood. Therefore, the aim of the present study was to fill this gap by investigating whether the individual factor involving empathy ability would relate to interpersonal regulation strategies. We also examined how relational factors, such as interpersonal closeness contribute to the process in a co-operative context.

Factors influencing IER strategies

Both intrinsic and extrinsic factors influence the selection of IER strategies by high school students. Intrinsic factors involve empathy capabilities, including affective empathy (feeling others' emotions) and cognitive empathy (understanding others' perspectives)[14]. The capacities for affective empathy and perspective-taking within these abilities enable middle school students to develop and maintain close interpersonal relationships[15]. Previous studies have indicated that personal distress is positively correlated to affect-worsening strategies, as those with high affective empathy is more likely to be motivated by others distress and become self-focused, thus showing more concern to their own emotional experience[3]. While recent study found empathic concern is linked to increased hedonic IER goals of wanting others to feel better as well as to higher perceived success in attaining these goals[16]. Whereas high cognitive empathy is related to affect-improving strategies, because those individuals are better able to control their own emotional experience and instead focus on the needs of others in distress[17–19]. Therefore, different components of empathy might be predictive of the preference and selection of various IER strategies. Regarding IER strategy selection in high school students, few studies have investigated its link to different empathy components. Thus, this study aims to testing the following hypothesis: affect-worsening strategy is significantly correlated with affective empathy, while higher cognitive empathy is predictive of affect-improving strategies among adolescents.

Extrinsic factors, such as interpersonal relationships, also significantly impact the selection of IER strategies[20]. Interpersonal relationships can largely be distinguished by emotional closeness (kinship with others) and reciprocity (norms concerning fairness, balance, and equity)[21]. Besides, IER is not necessarily experienced in isolation; rather, they regularly arise and are managed within a social context, which is influenced by social goals. In highly close relationships, one will tend to improve the emotional experiences of others to achieve social goals[22,23]. In co-operative settings (i.e., high reciprocity), one may sometimes opt to increase the anxiety level of another to meet work objectives[24]. In competitive situations, where individuals are focused on self-interest and outcomes that may limit resources or opportunities, emotion regulation strategies can be employed not only to manage one's own emotional state but also to influence the emotional states of others in ways that may further personal goals or disrupt competitors[25]. Indeed, the dynamics of emotional regulation may vary significantly depending on empathic accuracy and the interpersonal context. However, how adolescents' empathy ability interplay with the dynamics of the regulation strategies employed in co-operative and competitive contexts has been largely unexplored. Therefore, study 2 explores how different constructs of empathy affect the selection of IER strategies when individuals are facing regulation targets of varying interpersonal closeness in co-operative task (i.e., high reciprocity) in gaming contexts. In particular, this research introduces a cooperatively gaming paradigm to explore how individuals navigate these contrasting environments and select emotion regulation strategies in collaborative situations. Study 2 proposes the following hypothesis: interpersonal closeness can stimulate different motivations underlying the selection of IER strategies, thereby moderating the relationship between empathy ability and IER strategies among adolescents.

The present research

The current study aimed to assess the relationship between empathy and IER strategies of high school students that related to real-world situation. To achieve this, we first investigated how the selection of IER strategies related to various components of empathy by questionnaire (Study 1), Based on the findings of Study 1, if individuals with varying empathic abilities demonstrate differences in the use of interpersonal emotion regulation (IER) strategies, would such differences remain stable across contexts—such as when adjusting for social distance between the target and oneself, or when personal benefits are involved in specific scenarios (gaming context). When regulating targets with varying social distances and when the emotional adjustment and recovery of these targets directly impact personal interests, what patterns might emerge in the relationship between empathy and IER strategy use?

To address this gap, Study 2 was designed within a real-world experimental context that incorporates personal benefits and differences in regulation targets, aiming to further clarify the applied validity and generalizability of the questionnaire results from Study 1.Specifically, this experimental task examined how different components of empathy influence the application of IER strategies across various interpersonal closeness.

Study1

Two questionnaires were used to examine the preliminary relationship between empathy and IER strategies of high school students.

Method

Participants

The study participants included 414 high school students who completed valid questionnaires, randomly selected from four middle schools located in Beijing and Jinan, China. A total of 457 questionnaires were initially collected, and 43 invalid responses (with more than 60% answer repetition) were excluded using SPSS, resulting in a final participation rate of 90.6%. The participants ranged in age from 14 to 19 years old (M = 15.73,

SD = 0.89), including 164 males (39.6%) and 250 females (60.4%). We recruited participants through campus flyers with the aim of helping high school students better understand their mental health. The inclusion criteria were being a current high school student, and the exclusion criteria included a history of significant mental disorders or chronic physical illnesses. Participants who took part in the study were offered the opportunity to engage in a mental health activity program. The study was approved by the Ethics Committee of the Psychology Department at Beijing Union University and informed consent was obtained before testing. We confirmed that all experiments were performed in accordance with relevant guidelines and regulations.

Measures

Empathy. The Interpersonal Reactivity Index comprises four dimensions[26]: Perspective Taking (PT), Fantasy (FS), Empathic Concern (EC), and Personal Distress (PD), with each dimension having 7 items, for a total of 28 items. A 5-point scoring system will be used. Cognitive empathy (McDonald's ω = 0.845) scores are derived from the sum of scores on the Perspective Taking and Fantasy dimensions, while affective empathy (McDonald's ω = 0.865) scores are the combined scores of the Empathic Concern and Personal Distress dimensions.

IER strategies. The Emotion Regulation of Others and Self-scale[4] is used to measure the IER strategies of high-school students. The measure of EROS includes two sub-scales: affect-improving (6 items) and affect-worsening (3 items). All items are rated on a scale ranging from 1 ("not at all") to 5 ("very much"). Higher average scores on each subscale indicate more frequent use of that particular emotion regulation strategy. The reliability of the EROS questionnaire to assess affect-improving and affect-worsening strategies is considered good (McDonald's ω = 0.858 and 0.770, respectively).

The EROS translated version was piloted on high school students prior to its formal administration to test for appropriateness. Questionnaires were distributed, and out of 376, 351 indicators proved viable; the valid response rate is pegged at 93.3%. This sample consisted of 136 boys (38.7%) and 215 girls aged between 14 and 19 years ($M = 15.72$; $SD = 0.861$). The translation process involved forward translation by one psychology graduate student and one professor, followed by back-translation by two bilingual students. In order to ensure that semantic equivalence was achieved, five graduate students in psychology, along with two professors, constituted an Item Review Panel. The items were reviewed, and discrepancies were resolved. The content validity was further reviewed by an expert panel, which provided a SCVI for the scale of 0.8 and an average SCVI of 0.97, indicating that the translated measure has excellent content validity. Further item analysis, such as the item total correlation of each item with its subscale total being above 0.6 and discrimination tests of each item, was done, and all items showed good discrimination[27]. Reliability assessments taken systematically, with McDonald's ω coefficients at above 0.7, and factorial validities in the preliminary study further confirmed that the above translation and revision processes made the questionnaire appropriate and effective for this population.

Procedure

All participants completed questionnaires using the online behavioral experiment platform TC-LAB (https://www.testcloudlab.com/testcloud-study/index). Research conducted on this platform has been included in published articles[28]. After receiving consent from schools, teachers, and students, the surveys were administered in computer labs on a class-by-class basis. The data were immediately transferred upon completion of the questionnaires. The purpose of the survey was explained to the participants through instruction on the survey interface and confidentiality was guaranteed.

Study 1 will use SPSS software for data analysis. First, descriptive statistics and Pearson correlation analysis were conducted to assess the participants' IER strategies and empathy. Next, a regression analysis was conducted with cognitive empathy and affective empathy levels as the predictive variables, and the frequency of affect-worsening and affect-improving strategies as the dependent variables, respectively. Aiming to examine the predictive effects of different components of empathy on the use of different strategies.

Results

Descriptive statistics and Pearson correlation analysis were conducted to assess the IER strategies and empathy of the participants (Table 1). Cognitive empathy was positively correlated to affective empathy ($r = .543$, $p < .001$). Empathy was positively correlated with cognitive empathy ($r = .864$, $p < .001$) and affective empathy ($r = .892$, $p < .001$). Additionally, the affect-improving strategy was positively correlated to cognitive empathy ($r = .468$, $p < .001$), affective empathy ($r = .264$, $p < .001$), and empathy ($r = .410$, $p < .001$), whereas the affect-worsening strategy was only positively correlated to affective empathy ($r = 0.127$, $p < .01$).

Regression analysis was conducted with cognitive empathy and affective empathy levels as the predictive variables and the frequency of the affect-improving strategy as the dependent variable. The results showed a significant main effect of cognitive empathy on the affect-improving strategy ($Ro = 0.219$, F (2,411) = 57.538,

	Mean	SD	1	2	3	4
1 Cognitive Empathy	48.8744	7.309	1			
2 Affective Empathy	46.623	8.118	.543***	1		
3 Affect-improving	22.280	3.710	.468***	.264***	1	
4 Affect-worsening	7.046	1.723	.018	.127**	.090	1
5 Empathy	95.498	13.556	.864***	.892***	.410***	.086

Table 1. Descriptive statistics and correlations among the variables in study1. **$p < .01$, ***$p < .001$.

$p < .001$). Specifically, could significantly and positively predict the frequency of use of affect-improving strategy ($\beta = 0.460$, $p < .001$). The higher the cognitive empathy ability, the more frequently individuals use affect-improving strategies. However, affective empathy was not predictive of the affect-improving strategy (Table 2).

To examine whether demographic factors influence IER strategies, a multiple regression analysis was conducted by adding gender and age to the existing model.The analysis revealed that gender and age do not significantly predict the use of affect-improving (gender: $\beta = -0.538$, $p = .181$; age: $\beta = -0.269$, $p = .215$) or affect-worsening strategies (gender: $\beta = -0.263$, $p = .300$; age: $\beta = -0.040$, $p = .773$).

Further regression analysis was conducted with cognitive empathy and affective empathy levels as the predictive variables and the frequency of the affect-worsening strategy as the dependent variable. The results indicated that the level of affective empathy was significantly predictive of the affect-worsening strategy ($Rt = 0.020$, $F(2,411) = 4.162$, $p = .004$). Specifically, affective empathy was significantly and positively predictive of the frequency of the affect-worsening strategy ($\beta = .166$, $p = .004$). The higher the affective empathy level, the greater the use of affect-worsening strategies. However, cognitive empathy was not predictive of the affect-worsening strategy (Table 2).

In order to evaluate the potential of multicollinearity, the VIF values of all independent variables were calculated; this revealed that all VIF values are below 5. Therefore, the existence of severe multicollinearity cannot be assumed (cognitive empathy = 1.42, affective empathy = 1.42).

Discussion

Study 1 provides partial support for H1. Through a questionnaire method, Study 1 examined the relationship between empathy and IER strategies among high school students. Additionally, Study 1 preliminarily revealed that the higher the level of cognitive empathy among high school students, the more they tend to use affect-improving strategies in IER. Conversely, the higher the affective empathy level, the more they are inclined to use affect-worsening strategies. These findings are consistent with previous research results on the relationship between adult empathy and IER[3,17]. Although we obtained results through the questionnaire method in Study 1, IER strategies are ultimately employed in real-life situations. Therefore, Study 2 was conducted to assess the impact of empathy on IER strategies under conditions of co-operation in real-life situations, as the level of interpersonal closeness of the target of IER strategy also affects judgment of the potential benefit of the implemented strategy.

Study2

In this experiment, a real-life co-operative scenario was simulated. Participants were instructed to collaborate with a partner to complete a game. The partner was responsible for playing the game and trying to achieve a high score, while the participant was tasked with selecting the music to be played before playing the game for the partner. The music choices included tracks that induce feelings of anger (corresponding to the affect-worsening strategy) or happiness (corresponding to the affect-improving strategy). Selection of music tracks that induce feelings of anger indicates a preference of the participant for the affect-worsening strategy, while selection of music tracks that induce feelings of happiness indicates a preference for the affect-improving strategy. In addition, the type of music tracks selected by the participants was considered a measure of the IER strategy (decision). This approach was employed to clarify the motivations underlying the strategy chosen by the participants, especially when high school students realize that feelings of anger can help to achieve higher scores in the game. The overall aim of this experiment was to elucidate the motivations of selecting different empathy levels by the participants when choosing an IER strategy and how varying degrees of interpersonal closeness affect the strategy choice. Study 2 was also approved by the Ethics Committee of the Psychology Department at Beijing Union University and informed consent was obtained before testing. Besides, we confirmed that all experiments were performed in accordance with relevant guidelines and regulations.

Method

Participants

Using the NbClust package in R language[29], the optimal number of clusters for participants' cognitive empathy and affective empathy scores in study 1 was assessed. The Silhouette score was 0.5476 and the cubic clustering criterion (CCC) recommended two clusters for the cognitive empathy group, while the Silhouette score was 0.5635 and both the Krzanowski–Lai index and CCC recommended two clusters for the affective empathy group. These findings indicate that each group is composed of two distinct subgroups. Therefore, we conducted k-means clustering analysis on the cognitive and affective empathy scores using the Tidyverse and Cluster packages in

		Affect-improving				Affect-worsening		
	B	*β*	*t*	*p*	*B*	*β*	*t*	*p*
Affective Empathy	0.007	0.015	0.279	.780	0.035	0.166	0.355**	.004
Cognitive Empathy	0.233	0.460	8.852***	< .001	− 0.016	− 0.072	− 1.238	.216
F	57.538				4.162			
R^2	0.219				0.020			
ΔR^2	0.215				0.015			

Table 2. Regression analysis of the impact of empathy on IER strategies in study1. $^{**}p < .01$, $^{***}p < .001$.

R, resulting in a high cognitive empathy group ($n = 242$, $M = 53.6$, $SD = 4.44$), a low cognitive empathy group ($n = 172$, $M = 42.3$, $SD = 5.11$), a high affective empathy group ($n = 189$, $M = 53.5$, $SD = 4.44$), and a low affective empathy group ($n = 225$, $M = 40.9$, $SD = 5.64$). The groups were then combined into the following categories: high cognitive and high affective empathy group ($n = 144$), low cognitive and low affective empathy group ($n = 127$), high cognitive and low affective empathy group ($n = 98$), and low cognitive and high affective empathy group ($n = 45$).

To ensure balanced comparisons in Study 2, 128 participants (68 females, 53.1%; 60 males, 46.9%; aged 14–19 years, $M = 15.70$, $SD = 0.917$) were randomly selected from these four pre-existing empathy clusters with R language, forming equally sized groups ($n = 32$/group): high cognitive (Cog)/high affective (Affect) empathy group (13 males and 19 females), Low-cog/Low-affect group (20 males and 12 females), High-cog/Low-affect group (14 males and 18 females), or Low-cog/High-affect group (13 males and 19 females).

Procedure

This experiment was adapted from previous IER motivation studies[30,31]. The participants were informed that the purpose of this experiment was to assess the impact of different music genres on game performance. Groups consisted of the student seated immediately in front of the participant (or behind if seated in the first row) as the gaming partner, who actually played the game and earned scores, while the study participant was responsible for selecting the music tract before the game.

First, each participant was instructed to assess the relationship level with the gaming partner (1 = "not familiar at all," 7 = "very close"). The specific measures of the closeness of relationship levels are further described in Task and Material (*Assessment of interpersonal closeness*).

Next, the participants were instructed to read the description of the game task. Briefly, the gaming partner will engage in an aggressive game and a higher score results in more rewards that are shared between the participant and the gaming partner (i.e., co-operative situation). The participant was to select the music for the gaming partner to listen to before the game. Previous research has shown that feelings of anger can improve performance in aggressive games[32].

Subsequently, four music tracts were randomly played for 30 s each. After each track, the participants determined whether the gaming partner would listen to the music track, where 1 = "not at all" and 7 is "strong willing" (tendency). After all four music tracts were played, the participants finally chose the music tract for the gaming partner and rated the effectiveness of the music choice (final decision).

SPSS software was used to conduct descriptive statistics on effectiveness of perceived emotions to verify the effectiveness of the priming task. At the same time, a Pearson correlation analysis was conducted on the two items assessing interpersonal intimacy to examine the validity of the intimacy manipulation. Next, Pearson correlation analysis was performed on the final music choices made by the four groups to determine if there were any differences in strategy selection.

Following that, the *lavaan package* in R was used for path analysis on five different paths to explore the relationship between different types of empathy and the choice of interpersonal emotion regulation strategies. Subsequently, the "boot" package in R was applied to conduct a mediation analysis involving cognitive or affective empathy groups, different strategies, and preference for different type of music. The sample size was set to 5000, with a 95% confidence interval.

Tasks and materials

*Co-operation task***.** The selected aggressive game was "Total Takedown." The goal of the game was to drive a car on the road and cause destruction. The more items destroyed, the higher the score. The game was sourced from a popular youth online gaming platform in China, "4399," which is well-received by teenagers.

Emotion-inducing music clips. Two music clips were used to induce happiness, and two to induce anger that were randomly played for 30 s during the experiment. The effects of the music tracts were confirmed in previous studies[29,33,34]. The anger-evoking music tracts included "Inquisition Symphony" and "Refuse/Resist" by Apocalyptica, while the happiness-evoking tracks were "Dreamoz" by Lazy Dog 2 and "Bingo Bango" by Basement Jaxx. After listening to the music tracts, the study participants were instructed to complete the following two tasks about tendencies and final selection of the music tracts:

(1) Preference for emotion-inducing stimuli: Tendencies in the IER strategy selection. The study participants were instructed to listen to the music tracts and then to rate preferences for the gaming partner on a 7-point scale. The scores assigned to the music tracts represent the preference level for the corresponding IER strategy.

(2) Explicit music choice: Final selection of IER strategy. The study participants selected the music tracts for the gaming partners to either induce anger or happiness. The selection of anger-inducing music was considered an affect-worsening strategy, while the selection of happiness-inducing music was considered an affect-improving strategy.

Assessment of interpersonal closeness. The study participants rated interpersonal closeness with the gaming partner based on two questions: (i) "Please describe the degree of proximity in your relationship with your partner." and (ii) "Please rate the frequency of your daily interactions with your partner."

Perceived emotional efficacy: Task initiation effect. The study participants were instructed to evaluate the perceived effect of the music tract on the performance of the gaming partner using a 7-point scale.

Expected emotional state: Effectiveness of music tracts. The study participants were asked the following question to assess the value and arousal of the music tracts: "What emotional state do you expect your partner to experience after listening to the selected music?".

Results

Descriptive statistics of the effectiveness of perceived emotions showed that most of the study participants agreed that the selected music tracts enhanced the performance of the gaming partner ($M = 4.75$ $SD = 1.32$), indicating that the priming task was effective. Notably, 96.83% of the participants who chose happiness-inducing music believed that the gaming partner would feel happy after listening to the music, while 86.15% of those who selected music designed to induce anger believed that the gaming partner would experience anger after listening to the music. These results indicate that the selected music tracts were perceived to induce the intended emotions. Correlation analysis on two questions regarding the assessment of interpersonal closeness reveals a positive correlation($r = .811$, $p < .001$), proving that the manipulation of closeness is effective.

Analysis of the final music choices across the four groups categorized by high and low scores of cognitive empathy and affective empathy showed significant differences in the strategy choices (final music choices) among the four groups with Pearson $\chi^2(3, n = 128) = 23.600$, $p < .001$.

As indicated by the data in Table 3, individuals with higher levels of cognitive empathy were more likely to choose affect-improving strategies than those with lower levels of cognitive empathy. Furthermore, individuals with lower levels of affective empathy also tended to select affect-improving strategies as compared to those with higher levels of affective empathy. Meanwhile, individuals with lower levels of affective empathy were more likely to choose affect-worsening strategies as compared to those with higher levels of affective empathy, and individuals with lower cognitive levels were more likely to select affect-worsening strategies.

Next, the impact of cognitive/affective empathy levels on the choice of improving/worsening strategies was assessed, while incorporating the degree of interpersonal closeness. Since the empathy grouping is a categorical variable, during the path analysis process, two sets of dummy variables were employed: cognitive empathy (high vs. low) and affective empathy (high vs. low).

The *lavaan* package in the R language environment was used for path analysis. Based on previous research and the hypotheses of this study, the model specified five pathways: (1) Empathy Group → Preference for Emotion-Inducing Stimuli, (2) Empathy Group → Final Decision of IER Strategy, (3) Closeness → Preference for Emotion-Inducing Stimuli, (4) Closeness → Final Decision of IER Strategy, (5) Preference for Emotion-Inducing Stimuli → Final Decision of IER Strategy.

With a focus on the affect-improving strategy and the degree of preference, the results showed that paths (3) and (4) were not significant ($ps > .05$), while paths (1), (2), and (5) were significant ($ps < .01$). Bootstrap-based mediation effect analysis was conducted of the three variables (cognitive or affective empathy group, affect-improving strategy, and preference for happiness-inducing music) using the 'boot' package in R. The number of samples was set to 5000, with a 95% confidence interval.

As shown in Fig. 1, cognitive empathy had a significant direct effect on the affect-improving strategy, $b = 0.280$, $p = .001$, 95% CI = [−.444 to −.116], and a significant indirect effect through the preference for happiness-inducing music, $b = 0.079$, $p = .012$, 95% CI = [−.148 to −.022], accounting for 22.095% of the effect, indicating a partial mediation. Besides, the affective empathy had a significant direct effect on the affect-improving strategy, $b = 0.167$, $p = .05$, 95% CI = [.002 to .332], and a significant indirect effect through the preference for happiness-inducing music, $b = 0.067$, $p = .046$, 95% CI = [.009 to .142], accounting for 28.777% of the effect, indicating a partial mediation. Individuals with higher levels of cognitive empathy and lower levels of affective empathy tend to prefer happiness-inducing music during the process and are more likely to choose affect-improving strategies ultimately. The preference for happiness-inducing music acts as a partial mediator influencing the choice of affect-improving strategies.

With a focus on the affect-worsening strategy and degree of preference, the results of the cognitive and affective empathy group showed that paths (1) and (4) were not significant ($p > 0.05$). Therefore, these two paths were removed. As shown in Fig. 2, the results of cognitive empathy group showed: $\chi^2 = 1.488$, df = 2, $p = .226$, RMSEA = .062 [.158, .330]; CFI = .980; TLI = .940; SRMR = .053. This model demonstrated good fit. The results of affective empathy group showed: $\chi^2 = 0.123$, df = 2, $p = .885$, RMSEA = .000 [.107, .282]; CFI = .998; TLI = 1.148. This model demonstrated good fit. The results of the two models indicate that individuals with lower cognitive empathy and higher affective empathy were more inclined to choose affect-worsening strategies. In this process, the closer the relationship with the gaming partner, the greater the preference for anger-inducing music.

Discussion

Subjects with both high cognitive empathy and low affective empathy showed a preference for the affect-improving strategy and ultimately were more likely to choose the affect-improving strategy. Additionally, the preference for the affect-improving strategy demonstrated during the selection process could positively predict the final choice of affect-improving strategies. In contrast, groups with low cognitive empathy levels and high affective empathy levels tended to choose affect-worsening strategies, and in the IER process, these two groups

	Affect-improving	Affect-worsening
Low-cog and Low-affect	14 (43.75%)	18 (56.25%)
High-cog and High-affect	18 (56.25%)	14 (43.75%)
High-cog and Low-affect	25 (78.13%)	7 (21.88%)
Low-cog and High -affect	6 (18.75%)	26 (81.25%)

Table 3. Number of participants n (%) in each empathy group and final IER strategy.

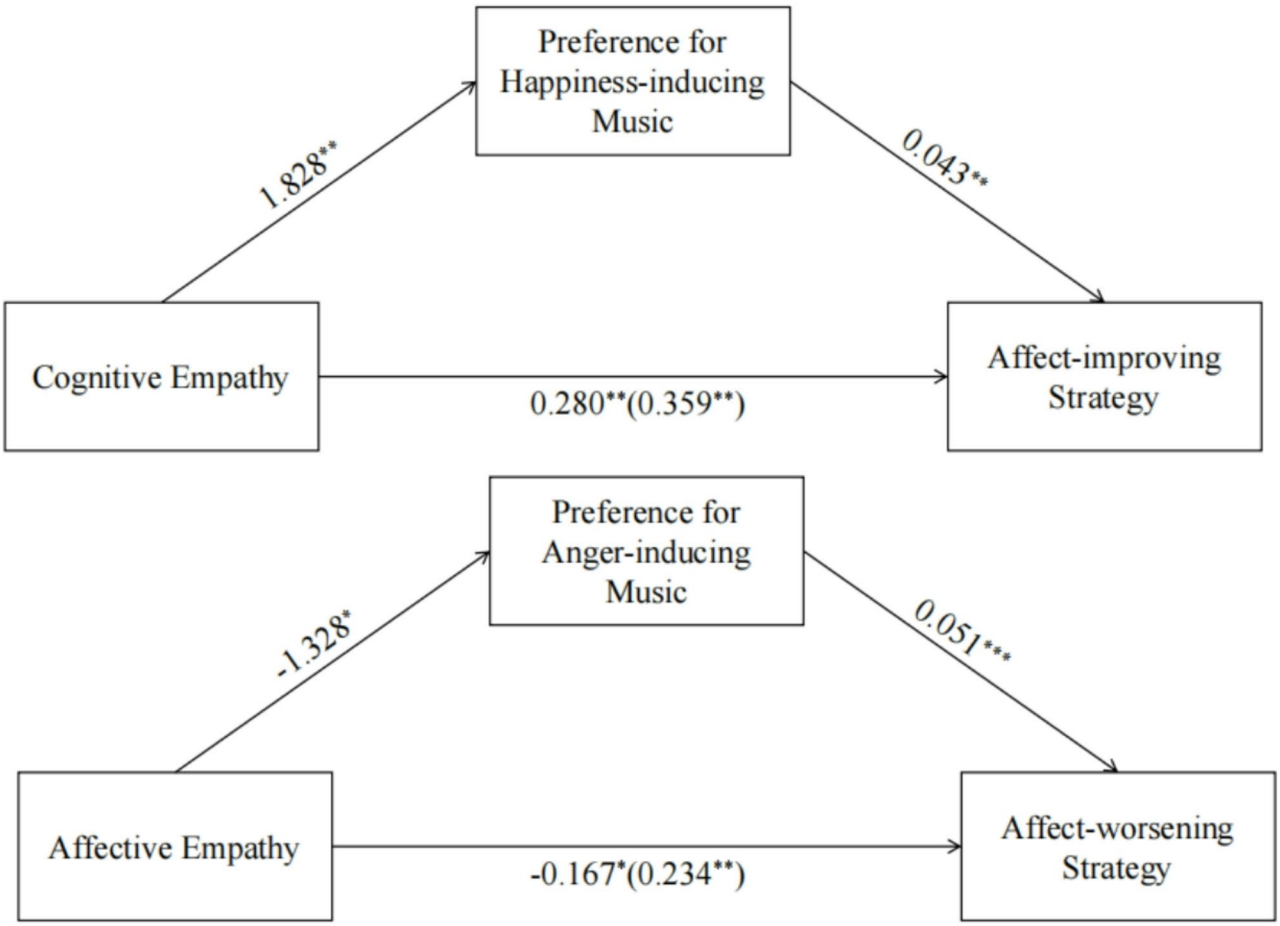

Fig. 1. The mediation model of *cognitive/affective empathy* and the *affect-improving strategy*, the *preference for happiness-inducing music* serves as the mediating factor, representing the inclination towards choosing the affect-improving strategy during the IER process. The *affect-improving strategy* was ultimately chosen by the study participants. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

of subjects were more likely to exhibit a preference for affect-worsening when facing a closer partner. These findings are in agreement with the results of a previous study[3].

General discussion

This study aimed to explore the relationship between the IER strategy by adolescents and the various dimensions of empathy, and to examine how this relationship affects their choice of IER strategy when dealing with regulators at different levels of closeness. The results showed that high cognitive empathy and low affective empathy were predictive of the use of affect-improving strategies. Additionally, individuals with low cognitive empathy and high affective empathy tend to prefer affect-worsening strategies, and the closer the relationship with the target of regulation, the higher the preference for affect-worsening strategies during the process.

The first hypothesis was that affect-worsening strategy is significantly correlated to affective empathy, adolescents with higher levels of cognitive empathy are more likely to choose an affect-improving strategy. The results partially confirmed our hypothesis, as validated by the questionnaire method in Study 1 and the experimental method in Study 2, showing that the higher the level of cognitive empathy, the more likely the choice of an affect-improving strategy. These findings are consistent with research suggesting that individuals high in cognitive empathy are more likely to employ up-regulation strategies, such as reappraisal, to improve the emotional state of others when they are in distress[35]. Moreover, affective empathy was not only positively correlated to the affect-worsening strategy, but could also inversely predictive of an affect-worsening strategy, demonstrating the higher the level of affective empathy, the more likely the choice of an affect-worsening strategy. Consistent with findings that individuals with higher empathic concern tend to have stronger emotional reactions to others' dilemmas, which may lead them to adopt down-regulation strategies such as inhibition, which may worse their own and others' negative emotions[36,37].

Individuals with high levels of cognitive empathy, especially the ability of perspective taking in cognitive empathy plays a significant role and correlates positively with the efficiency of improving another person's emotional state[18,38,39]. Perspective taking refers to the ability to understand the feelings of others without necessarily implying that the empathizer is in an affective state himself, which facilitates the projection of self

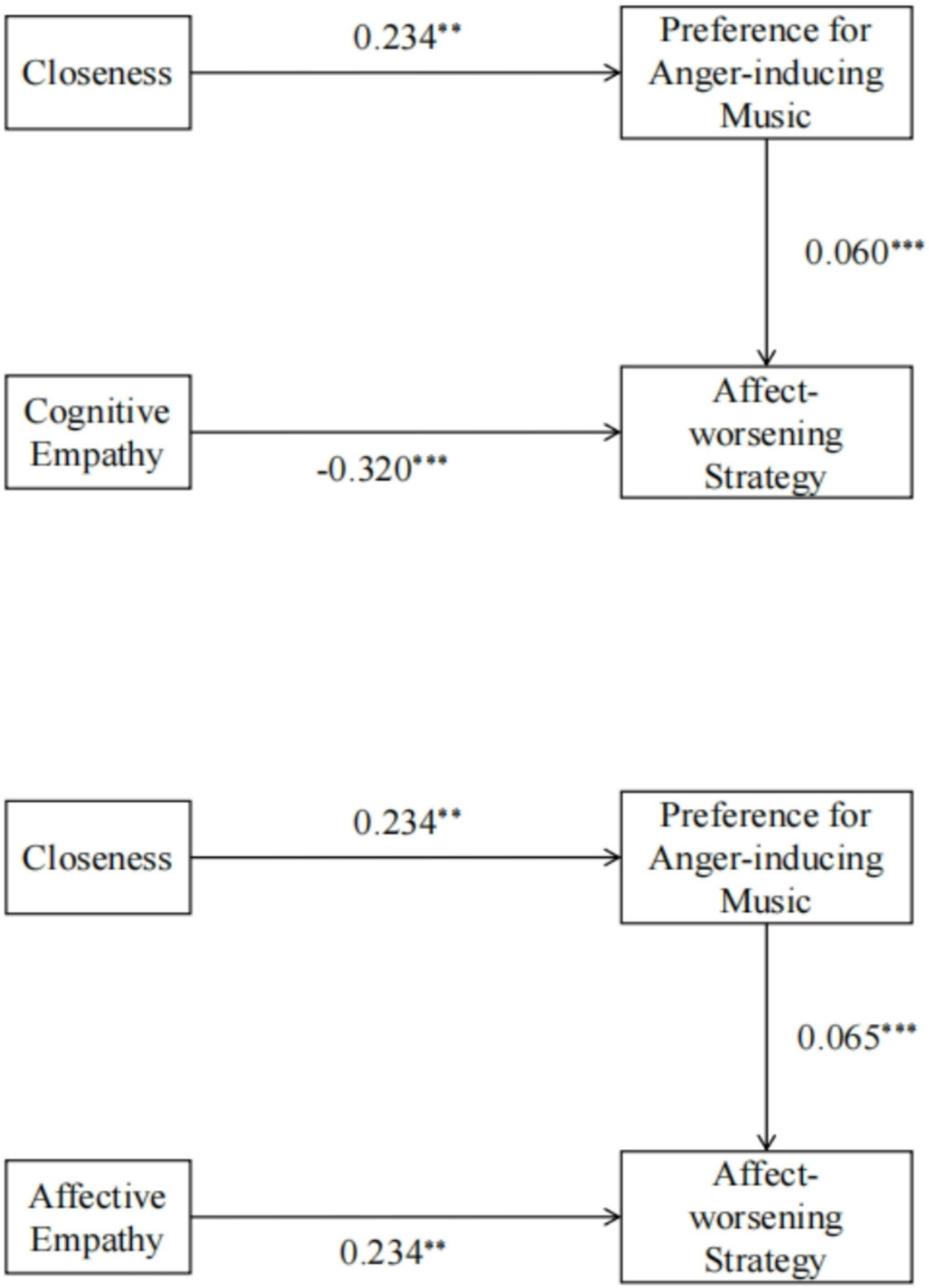

Fig. 2. Path analysis of the *affect-worsening strategy* of the cognitive empathy group (upper section) and the affective empathy group (lower section). The *preference for anger-inducing music* was the inclination toward choosing the affect-worsening strategy during the IER process. The *Affect-worsening strategy* was ultimately chosen by the participants. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

into the other distressed person, and makes them be able to imagine conflicting noncurrent mental states, thus resulting in a sort of other-oriented emotional response congruent with the other's perceived welfare. In other words, a certain level of perspective taking competence helps to improve other-interested feelings. Besides, in the process of IER, the regulator's emotions tend to synchronize with the target's emotions[40–42]. This implies that

if the target exhibits a low emotional state, the regulator might also experience distress[43]. Therefore, individuals with high cognitive empathy might improve the other's emotional experience to reduce their own discomfort.

On the other hand, previous study shows that the ability of personal distress (affective empathy) positively predicts the use of affect-worsening strategies[44,45]. Personal distress is a negative affective state that can be elicited by the perceived, imagined, or inferred state of the affective state of another, but is rather self-centered than other-oriented. Individuals with high levels of affective empathy in interpersonal interactions tend to focus more on themselves, wishing to improve their own emotional experiences, thus embodying a form of egotism within pro-social behavior and fail to consider the emotional states and thoughts of others[46]. Hence, affect-worsening strategies might be selected to regulate the emotions of another to improve one's own emotional experience[44,45].

The second hypothesis posited that interpersonal closeness influences the selection of an IER strategy. However, our hypothesis was only partially supported, as the results showed that closeness had a significant effect on the preference for affect-worsening strategies in both the low cognitive empathy and high affective empathy groups, with closer relationships leading to a higher preference for affect-worsening. This effect was not observed in the high cognitive empathy and low affective empathy groups because individuals with higher levels of cognitive empathy are motivated by long-term utilitarian motives and tend to prefer affect-improving strategies, while those with lower levels of cognitive empathy are more influenced by short-term utilitarian motives[31]. Regardless of the regulation target, individuals with high cognitive empathy consistently choose affect-improving strategies. In Study 2, the regulation targets were classmates of the participants. Students with high cognitive empathy tend to establish longer-term interpersonal relationships and thus opt for affect-improving strategies (long-term utilitarian motives). However, those with low cognitive empathy tended to only consider immediate goals (improving game performance to obtain more rewards), particularly when paired with a closely related partner, as they were more willing to sacrifice the emotional feelings of the partner in favor of higher game rewards. This further validates that individuals with high cognitive levels indeed choose an IER strategy based on utilitarian motives[47]. Individuals with high levels of affective empathy are more inclined to choose affect-worsening strategies, as motivations are very likely similar to those of individuals in the low cognitive empathy group, dominated by short-term utilitarian motives. Conversely, the choices of individuals with low affective empathy are often motivated by the pursuit of pleasure[32], which is hedonism, a concept opposed to utilitarianism.

Between-cultures difference of empathy and IER may be significant in interpreting the results of this study[46]. Precisely, in collectivist East Asian cultures, people tend to be interdependent with others, valuing social responsibility and harmony[47]. Adolescents high in cognitive empathy and low in affective empathy are sensitive to social norms related to maintaining relational harmony. Such adolescents may tend to adopt strategies for improving affect and avoiding behaviors that disrupt social cohesion or the emotional state of others—even when doing so might create possible short-term utilitarian motives. Indeed, East Asian participants benefited more from using perspective taking to enhance others' positive affect than Western European participants[47]. In Western samples, where strategies that worsen affect might be more permissible under norms allowing self-expression and immediate personal gain[48]. Low cognitive-empathy-high affective-empathy adolescents within the same culture display another pattern. These individuals tend to experience intense emotional contagion from others but lack sufficient perspective-taking to fully understand the context and emotional needs of their interaction partners. Due to strong emotional resonance and limited cognitive function, they may adopt suppressive IER strategies, aimed primarily at reducing their own emotional discomfort rather than genuinely enhancing relational harmony[49]. While such strategies do achieve superficial harmony, continued suppression could cause emotional exhaustion and damage psychological well-being. In this regard, interventions addressing such adolescents must also pay attention to encourage more effective IER strategies[50]. That will allow better interpersonal interactions in the context of collectivist cultures to occur. Overall, such cultural differences call for culture-sensitive interpretations of empathy-related emotion regulation behaviors.

Research strengths, limitation and future directions

It is essential to note strengths and limitations of the present study, as well as directions for future research. A strength is the combination of both the questionnaire and experimental method, which extends theoretical results of IER strategies selection to real-world situations.

There were several limitations to this study that should be addressed. First, this study focuses on IER strategies, as opposed to previous research that focused on the regulation of intrapersonal emotion. However, the manipulation of individual differences, such as sensation-seeking tendencies and baseline differences in competitiveness among participants could affect preferences for IER strategies, especially in gaming contexts in this study. Hence the experimental design and its ecological validity needs further improvement and validation in real interpersonal relationship scenarios. Second, although the tendencies of the participants to regulate the emotions of others were assessed, our studies exclusively contain reports by regulators without information on regulation outcomes (e.g., changes in game results and relationship closeness) or consequences for regulatees (e.g., helpfulness of received IER). Future research could benefit from dyadic designs and incorporated outcome measures. Finally, some methodological defects in the present study should be considered. Although dichotomization of participants into high/low empathy groups offered a simplified view to delineate its link with IER strategies, it reduced statistical power and risked oversimplifying complex associations of them, as empathy is a fundamentally continuous variable. Future research should consider analyzing empathy and IER strategies with multiple statistical approaches.

Data availability

The data can only be obtained by researchers following the study publication protocol. The datasets and protocol can be obtained by emailing to the corresponding author: wunantom@126.com.

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Author contributions
X.M. and N.W. conceived and designed the study. X.M. performed the experiments and collected as well as analyzed the data. Q.C.W. contributed reagents/materials/analysis tools and interpretation. X.M. drafted the manuscript. N.W. and S.X.L. provided revision. All authors approved the final version of the manuscript for submission.

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Declarations

Competing interests
The authors declare no competing interests.

Ethics approval
All procedures performed in studies involving human participants were approved by the Ethics Committee of the Psychology Department at Beijing Union University.

Consent to participate
Informed consent was taken from each participant before data collection.

Additional information
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