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The Interplay between Negative Activating Emotions, Family Expressiveness, and Gender: Implications for Creativity

ABSTRACT

Research on the implications of negative emotions for creativity has yielded mixed findings. To clarify this relationship, we conducted a short-term prospective study with data collected across two time points. We also explored the moderating roles of family expressiveness and gender in the creative process. The sample included 392 Japanese adolescents (54.7% female; age range: 12–13 years old). Adolescents reported on their experiences of negative activating emotion (e.g., fear, anxiety) and the degree to which their family members expressed positive emotions (e.g., expressing gratitude) toward each other. A drawing task and an alternative uses task (AUT) were used to measure adolescents' creativity. For creativity expressed in the drawing task, negative activating emotion enhanced creativity in girls only when their families' emotional expressivity was of low or average levels. For creativity indexed by the AUT, a high level of family expressiveness strengthened the relationship between negative activating emotion and creativity in boys but suppressed such a relationship in girls. Findings suggest that, at least among Japanese adolescents, the associations between negative activating emotions and creativity can depend on multiple factors, including family emotional expressivity, gender, and the nature of the creativity task.

Keywords: creativity, emotion and creativity, negative activating emotion, family expressiveness, gender.

Various artists throughout history were known to have experienced major emotional turmoil in their lives. From Van Gogh's well-known struggles with depression to Edvard Munch's use of art as a way to cope with anxiety, the role of emotions, particularly negative emotions, in creativity has long been a subject of scholarly interest (e.g., Mumford, 2003; Shaw & Runco, 1994). Unfortunately, conflicting findings in the literature have made it challenging to understand the exact role of negative emotions in the creative process. While some studies have found that negative emotions can enhance creativity (e.g., Akinola & Mendes, 2008; De Dreu, Baas, & Nijstad, 2008), such a relationship was not evident in other studies (e.g., Baas, De Dreu, & Nijstad, 2008; Isen, Daubman, & Nowicki, 1987). It is possible that external factors can qualify the associations, including the type of creativity tasks (Friedman, Förster & Denzler, 2007), the arousal level of emotions (De Dreu et al., 2008), and the context in which creativity is expressed (George & Zhou, 2007). Despite these illuminating efforts, the role of the family environment in the creative process has received little attention thus far. The current study examined the role of negative activating emotions (e.g., anger and anxiety) in creativity among adolescents, with attention to how such associations may be dependent on the family emotional climate and gender.

EMOTION AND CREATIVITY

A sizable body of research has explored the relationship between emotion and creativity (e.g., Baas et al., 2008; Davis, 2009). Baas et al.'s (2008) meta-analysis indicates that positive emotions enhance creativity, as reflected in increased originality and fluency, to a greater extent than neutral or negative emotions. In contrast to the relatively consistent pattern documented for the role of positive emotions, studies focusing on the relationship between negative emotions and creativity have yielded mixed findings. For example, several studies reported no effect of induced negative emotions on creative problem-solving and divergent thinking relative to induced neutral emotions in American college students (Grawitch, Munz, &

Kramer, 2003; Hirt, Melton, McDonald, & Harackiewicz, 1996; Isen et al., 1987). Another study using self-report measures found negative relationship between negative emotions and creativity among college students in Norway (Vosburg, 1998). On the other hand, a handful of studies demonstrate that negative emotions can facilitate creative thinking in Western cultures, such that anxiety and depression are positively associated with creativity among college students (Carlsson, 2002; Verhaeghen, Joorman, & Khan, 2005). Furthermore, experimental work indicates that induced negative emotions enhance creative problem-solving (Kaufmann & Vosburg, 1997) and artistic creativity (Akinola & Mendes, 2008).

De Dreu et al. (2008) argue that a comprehensive understanding of the emotion–creativity relationship requires an examination of the activation levels of emotions (i.e., activating vs. deactivating), in addition to valence (i.e., positive vs. negative). The notion of activation levels refers to the degree of physiological arousal associated with an emotional state (Posner, Russell, & Peterson, 2005). For example, negative activating emotions are those that are associated with high levels of arousal but have a negative valence, such as anger, fear, and anxiety. De Dreu et al. (2008) proposed that activating emotions can enhance cognitive flexibility and persistence by increasing information-seeking and working memory capacity, which in turn can facilitate the creativity process (Flaherty, 2005; Nieuwenhuis, Aston-Jones, & Cohen, 2005; Usher, Cohen, Servan-Schreiber, Rajkowski, & Aston-Jones, 1999). In line with this notion, negative activating emotions (e.g., fear and anger) are associated with creative thinking among college students in the Netherlands, as reflected in improvements in divergent thinking, insight, and cognitive flexibility (De Dreu et al., 2008). By contrast, negative deactivating emotions (e.g., sadness and depression) have been found to have no effect on creativity (De Dreu et al., 2008). In addition, To, Fisher, Ashkanasy, and Rowe (2012) found that, among Australian college students, the experience of negative activating emotions, but not negative deactivating emotions, can facilitate creative process engagement, a critical precursor of creative performance. Despite research documenting the association between negative activating emotions and creativity, it is notable that Baas et al.'s (2008) meta-analysis showed that two forms of negative activating emotions, fear and anxiety, were generally negatively associated with creativity.

FAMILY EXPRESSIVENESS AS A CONTEXT

Family plays a crucial role in shaping adolescents' social and cognitive development. A supportive family environment has been shown to enhance self-efficacy and motivation, which can, in turn, facilitate creativity among East Asian adolescents (Chan, 2005; Cho & Lin, 2010; Tang, Duan, & Long, 2022). A recent large-scale survey in China revealed that adolescents were more likely to engage in creative behaviors and experienced higher self-efficacy in creativity when their parents encouraged open expression of ideas (Tang et al., 2022). Similarly, an analysis of gifted young adolescents in Hong Kong found that those who resided in family environments characterized by support, interdependence, and resilience tended to rate themselves as more creative (Chan, 2005). In Korean families, positive family processes, including parental support, were found to be predictive of children's creative problem-solving behaviors in STEM (Cho & Lin, 2010).

Despite research demonstrating the importance of general family support for creativity among East Asian adolescents (Chan, 2005; Cho & Lin, 2010; Tang et al., 2022), scant research has focused specifically on the emotional climate co-created by all family members – family expressiveness (Halberstadt, Crisp, & Eaton, 1999). Positive family expressiveness, characterized by behaviors such as expressing excitement and praise, has been associated with positive developmental outcomes across both East Asian and Western cultures. Such positive family environments can enhanced emotional awareness and expression, use of emotion regulation strategies, social competence, self-esteem, and cognitive functioning (Chen, Wu, & Wang, 2018; Eisenberg et al., 2001, 2003; Halberstadt et al., 1999; Morris, Silk, Steinberg, Myers, & Robinson, 2007). According to Koerner and Fitzpatrick (2002), communication within the family that prioritizes open expression of emotions is a key dimension of positive family functioning, which can result in positive socioemotional outcomes. Research focusing on young adults in the United States indicates that individuals residing in families that are more open about expressing emotions tend to exhibit higher well-being, with such an association fully mediated by cognitive flexibility (Koesten, Schrodt, & Ford, 2009). An examination of Chinese families with children aged 9–10 also identified the association between family expressiveness and cognitive flexibility, such that the more children openly expressed their emotions within the family, the faster children flexibly switched between different sets of information (He & Yin, 2016). Conceivably, given its potential influences on the development of cognitive flexibility, an emotionally supportive environment can strengthen the association between emotion and creativity.

GENDER AS A POTENTIAL MODERATOR

Research has consistently demonstrated gender differences in emotional expressivity, particularly during adolescence (Brody, 1999; Zhou et al., 2002). A meta-analysis examining gender differences in emotion expression from infancy through adolescence suggests that during preschool age and middle childhood, girls are less likely to express negative emotions, such as anger, compared to boys. However, girls tend to express more negative emotions than boys during adolescence (Chaplin & Aldao, 2013). Given these findings, a key question is whether gender moderates the role of family expressiveness in the purported link between negative activating emotion and creativity, especially during adolescence. Research provides support for the importance of considering gender in understanding the relationship between family practices and children's socioemotional development among African American families (Cunningham, Kliewer, & Garner, 2009). Similarly, the impact of family emotional climate on creativity could depend on gender-typed emotional socialization and children's sensitivity to such experiences. For example, research indicated that Chinese girls were more likely than Chinese boys to use maladaptive emotion regulation strategies, like venting, when their mothers expressed negative emotions (Chen et al., 2018). Furthermore, negative expressions conveyed in American families dampened the development of emotion regulation skills among girls to a greater extent than boys (Denham, Mitchell-Copeland, Strandberg, Auerbach, & Blair, 1997).

Emerging research using American samples shows that boys appear to be more sensitive to the family environment in their development of externalizing behavior (Miner & Clarke-Stewart, 2008). A meta-analysis demonstrated that the relationship between parenting and externalizing behavior is stronger in boys compared to girls (Rothbaum & Weisz, 1994). In the context of Japanese children with mature Theory of Mind, negative maternal emotional expression were correlated with increased aggression in boys but not in girls (Mizokawa & Hamana, 2020). Hence, it is possible that the moderating role of family emotional climate on the association between negative emotions and creativity may differ between boys and girls.

THE PRESENT STUDY

The current research was designed to shed light on the relationship between negative activating emotions and adolescents' creativity, with attention to the potential moderating roles of family emotional expressiveness and gender. A short-term prospective design was used to understand the associations between negative emotion and creativity both concurrently and prospectively. The current research focused on adolescence for two reasons. First, during this developmental phase, children undergo increasing negative emotions and emotional shifts (Larson, Moneta, Richards, & Wilson, 2002; Rosen et al., 2018), making it a particularly important period to understand the role of emotions in creative performance. Prior research on the emotion–creativity link has primarily focused on adults and individuals with a predisposition to mood disorders (Akinola & Mendes, 2008; Baas et al., 2008). As such, it remains unclear how emotions affect creativity in developing individuals, such as adolescents. Second, during early adolescence, the family environment, including the family's emotional expressivity, continues to play a pivotal role in shaping children's social and psychological outcomes, albeit increasing significance of peers (Hofferth, 1985). We hypothesized that positive family expressiveness would strengthen the positive relationship between negative activating emotion and creativity. Additionally, we expected that the interplay between negative activating emotion, family expressiveness, and creativity would differ between boys and girls.

METHODS

PARTICIPANTS

Data were drawn from a larger study[1] focusing on the role of sociocultural influences in adolescents' emotional and social adjustment in Japan. The sample included 392 Japanese (54.7% female) adolescents between the ages of 12 and 13 (M = 12.6, SD = 0.5) at the start of the study. Participants resided in two cities in the Osaka and Shiga Prefectures in Japan. At the time of the study, the average monthly household income in these two cities were ¥503,219 and ¥512,144, respectively (USD 3362.15 and USD 3421.78) (Statistics Bureau of Japan, 2016).

[1] For more information, see Delany, Cheung, Takahashi, and Cheung (2019) and Kyeong, Knapp, Takahashi, Davis, and Cheung (2024).

PROCEDURE

Participants were recruited from two middle schools in the Osaka and Shiga Prefectures. Informed consent was obtained from the school principals, and students who provided assent to participate were included in the study. Participants were involved in the study at two time points, with a 6-month interval in between. At each data collection time point, participants filled out a survey and completed several creativity tasks during class time. A teacher was present in each classroom to facilitate survey administration. For each survey they completed, participants received a $5 gift card as a token of appreciation. The study procedure was approved by the institutional review board of Kyoto University. Missing data were present within each wave. Little's MCAR test (Little, 1988) indicated that data were missing completely at random at both Wave 1, χ^2 (10) = 8.14, p = .615, and Wave 2, χ^2 (12) = 15.16, p = .233.

MEASURES

The measures included in the current research were originally developed in English. All measures were translated into Japanese by native Japanese speakers. Next, following guidelines from Brislin (1980) and Erkut (2010), a different team of Japanese research assistants back-translated the Japanese measures into English. The back-translated materials were compared with the English version to ensure the translation did not significantly deviate from the source.

Creativity assessments

Adolescents' creative thinking was measured by two creativity tasks: A drawing task (Torrance, 1966) and an alternative uses task (AUT) (Guilford, 1967).

Drawing task

Two figural subtests from the Torrance Tests of Creative Thinking (TTCT; Torrance, 1966) were used to measure adolescents' creativity: Picture Completion and Repeated Figure (see Appendix S1). In the Picture Completion subtest, participants were given an incomplete drawing and were told to "complete the following picture." In the Repeated Figures subtest, participants were given a picture with seven circles. Participants were instructed to "draw anything you want using the circles below." There was no time limit for both tasks. The instructions did not specify that the tasks assessed creativity, nor were participants informed about whether or how their drawings would be evaluated.

Trained raters coded the drawings after completing a two-part training process. Initially, undergraduate research assistants were trained on the definitions and examples of each coding category, then practiced in pairs with 20 samples until at least 80% agreement was attained within pairs of raters. Following the two-part training, raters worked in pairs to complete the coding procedure.

The coding was based on two dimensions of creativity outlined in the TTCT manual (Torrance, 1966): Frequency and Elaborateness. Frequency referred to the number of different drawings completed by the participant. Elaborateness referred to the extent to which participants add additional ideas to the drawing, rated on a Likert scale from 1 (no added details) to 5 (details are added to the drawing). Skewness was observed for both coded dimensions (range of skewness: 0.59–4.14). As such, log-transformation was performed to restore normality. An index of creativity based on the drawing tasks was obtained by taking an average across the Frequency and Elaborateness dimensions based on the log-transformed data.

Alternative uses task

The AUT is a verbal assessment designed to measure divergent thinking (Guilford, 1967). In the current study, two AUT tasks were administered. In the first task, participants were provided with a sheet of paper and were told to "list as many uses for a mirror as you can." The second task was identical, but focused on possible uses of a newspaper. Similar to the drawing tasks, there was no mentioning that these tasks assess creativity. Participants were oblivious as to whether and how their responses would be scored.

Each aspect of the AUT was rated by two trained Japanese research assistants, both of whom were graduate students in psychology. After the initial rating, the kappa coefficient was calculated. The kappa values were greater than 0.80. Any discrepancies between the raters were resolved by involving a third rater in a discussion. In all cases, consensus was reached after the discussion.

Participants' responses were coded based on six markers of creativity: Fluency, Originality, Elaborateness, Practicality, Inventive, and Unintended Use. Following prior research practice (Baas et al., 2008), we focused on Fluency, Originality, and Elaborateness. Fluency reflected the number of relevant ideas generated by each

participant (e.g., "use the newspaper to make a paper airplane" scored a point for Fluency, "New York Times" did not score a point for Fluency). Originality was defined as the number of statistically uncommon ideas generated by each participant. To establish a list of frequent responses, we developed a norm of all ideas pooled from the responses generated by the participants in the current research. Any uncommon ideas (i.e., those infrequently represented in the pool) were assigned a score for Originality. As with the drawing task, Elaborateness reflected the extent to which participant were able to expand upon their ideas. Specifically, a point was assigned to any elaborated ideas (e.g., "use the reflection of a mirror to blind somebody"), while ideas that were not further developed received a score of 0 (e.g., "see reflection"). The coded data for all three dimensions were skewed (range of skewness: 1.32–4.10). Hence, log-transformation was used to restore normality. An overall creativity index on the AUT was computed by taking an average across the Fluency, Originality, and Elaborateness dimensions based on the log-transformed data.

Negative activating emotion

To assess adolescents' emotional experience, items from the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) were used. Adolescents reported on how frequently they had experienced eight negative activating emotions (i.e., nervous, worried, anxious, fearful, frustrated, irritated, mad, angry) over the past week, using a 5-point Likert scale ranging from 1 (never) to 5 (very often). The scale exhibited high reliability across each wave of data collection (αs > .84). Participants' subjective experiences of negative activating emotions were computed by taking an average across all items comprising the negative emotions dimensions.

Positive family expressiveness

The Family Expressiveness Questionnaire (FEQ; Halberstadt, 1986) was used to measure the climate of emotional expression within the family. For the purpose of the current research, items comprising the positive emotional expression subscale were used (e.g., "expressing excitement over one's future plans"). Participants reported on how often each situation happened in their family using a 9-point Likert scale ranging from 1 (never/rarely) to 9 (very frequently). Positive family expressiveness was computed by taking an average across all 20 items. The positive family expressiveness subscale showed high reliability at both data collection time points of the study (αs > .90).

RESULTS

MEASUREMENT INVARIANCE

To allow for valid comparisons between girls and boys, it is crucial that the measures demonstrate measurement invariance. Given that the current study focused on comparing the relationship between variables among two groups, the establishment of metric, but not necessarily scalar, invariance was required. Metric invariance ensures that the loading of each item on the latent variable is comparable across groups (Chen, 2008). Tests of measurement invariance were performed for the measures of emotions and family expressiveness. As the creativity assessments were not self-reported, the test of measurement invariance was not required.

We conducted two-group confirmatory factor analyses to test metric invariance using Mplus 8.7 (Muthen & Muthen, 2021). Two latent constructs were constructed at each wave, one for negative activating emotions and another for positive family expressiveness. Items were randomly assigned into parcels based on recommendations by Little, Cunningham, Shahar, and Widaman (2002). To assess metric invariance, we compared an unconstrained model, in which all parameters were freely estimated, to a constrained model, where the factor loadings were identical between boys and girls. We used the difference of chi-square and degrees of freedom between these two models as a criterion to determine if the factor loadings were equivalent between boys and girls. A significant result from the chi-square difference test indicates a lack of metric invariance. As shown in Appendix S2, none of the chi-square difference values reached statistical significance. These results supported metric invariance, allowing valid comparisons of the associations between girls and boys.

CORRELATION AMONG EMOTION, FAMILY EXPRESSIVENESS, AND CREATIVITY

Table 1 displays the means and standard deviations of all variables for both boys and girls, as well as statistics from an independent sample *t*-test. For positive family expressiveness and drawing creativity, the

TABLE 1. Descriptive Statistics and Gender Comparisons for the Main Study Variables

	Boys		Girls		*t*	*p*
	M	*SD*	*M*	*SD*		
Wave 1						
Negative Activating Emotion	3.04	0.78	2.95	0.85	1.11	.266
Positive Family Expressiveness	5.61	1.30	5.03	1.31	4.18	<.001
Drawing Creativity	0.32	0.14	0.28	0.15	2.30	.022
AUT Creativity	0.64	0.21	0.57	0.20	3.22	.001
Wave 2						
Negative Activating Emotion	3.04	0.85	3.00	0.82	0.42	.674
Positive Family Expressiveness	5.59	1.29	5.04	1.36	3.90	<.001
Drawing Creativity	0.30	0.15	0.26	0.14	2.61	.009
AUT Creativity	0.57	0.21	0.54	0.21	1.41	.161

means were higher for boys than girls at both waves. Boys scored higher than girls on AUT at Wave 1 but not Wave 2.

Table 2 presents the correlations among variables. At Wave 1, negative activating emotions were positively correlated with creativity in the drawing task at Wave 1 among girls. At Wave 2, negative activating emotions were positively linked with their AUT performance among boys. Notably, this correlation differed significantly from that of girls, as indicated by a contrast in the correlation coefficients ($z = 2.62$, $p = .008$).

Positive family expressiveness was positively correlated with negative activating emotions at both waves, regardless of gender. Additionally, family expressiveness was negatively associated with performance in AUT among girls at Wave 2. This negative relationship between positive family expressiveness and AUT performance was significantly different between girls and boys, $z = 2.11$, $p = .035$.

THE MODERATING ROLES OF FAMILY EXPRESSIVENESS AND GENDER

Concurrent analysis

We first examined the concurrent relations between positive family expressiveness, negative activating emotion,[2] gender, and creativity. To this end, we conducted hierarchical multiple regression analyses for Wave 1 and Wave 2 separately, using R 4.1.2 (R Core Team, 2021). In Step 1 of the regression model, we included negative activating emotion, positive family expressiveness, and gender (coded as 1 for male and 2 for female) as predictors. Next, in Step 2, all possible two-way interaction terms between the predictor variables were included. To further explore potential gender differences in these associations, we added the three-way interaction term to the model in Step 3. Table 3 presents the results of the hierarchical multiple regression analysis. For clarity and coherence, we first present the results for the drawing task, followed by those for the AUT.

Drawing task

A three-way interaction between positive family expressiveness, negative activating emotion, and gender was observed, with significant effects at Wave 1 ($\beta = -1.60$, $p = .040$) and marginally significant results at Wave 2 ($\beta = -1.45$, $p = .068$). These findings suggest that the association between negative activating emotions and drawing creativity depended on the level of positive family expressiveness and varied between boys and girls.

Figure 1 provides a visual representation of the interaction between negative activating emotion, positive family expressiveness, and gender for each wave. To further probe the three-way interaction, simple slope analyses revealed that at Wave 1, there was a positive association between negative activating emotions and their drawing creativity among girls, particularly when they reported low ($B = 0.04$, $SE = 0.02$, $p = .009$) and average ($B = 0.03$, $SE = 0.01$, $p = .039$) levels of positive family expressiveness. In contrast, for boys

[2] Subdividing negative activating emotion into prevention-focused and promotion-focused emotion (Baas et al., 2008) yielded the same pattern of findings. For parsimony, we only present results focusing on negative activating emotions.

TABLE 2. Correlation Coefficients among Negative Activating Emotion, Positive Family Expressiveness, and Creativity, by Gender

	Boys	Girls	*z*
Wave 1			
NE-Drawing	.11	.19*	−0.71
NE-AUT	.12	.06	0.50
FE-NE	.17*	.16*	0.11
FE-Drawing	.10	.14	−0.42
FE-AUT	.15	−.03	1.64
Wave 2			
NE-Drawing	−.02	.09	−0.97
NE-AUT	.23**	−.06	2.62*
FE-NE	.18*	.20**	−0.22
FE-Drawing	−.04	−.06	0.18
FE-AUT	.06	−.17	2.11*

Note. NE, negative activating emotion; FE, positive family expressiveness; Drawing, creativity scores in drawing task; AUT, creativity scores in AUT. *z*-Score is computed to compare the correlation coefficients between genders. *$p < .05$. **$p < .01$.

TABLE 3. Concurrent Predictors of Creativity Expressed in Drawing and the Multiple Uses Tasks

Variables	Wave 1		Wave 2	
	Drawing	AUT	Drawing	AUT
	β	β	β	β
Step 1				
Negative Activating Emotion	0.14*	0.08	0.05	0.09
Positive Family Expressiveness	0.10†	0.04	−0.07	−0.09
Gender (1 = Male, 2 = Female)	−0.09	−0.16**	−0.15**	−0.09
Step 2				
Negative Activating Emotion	0.09	−0.02	−0.27	0.62**
Positive Family Expressiveness	0.08	0.03	−0.26	0.36†
Gender (1 = Male, 2 = Female)	−0.29	0.23	−0.32	0.80**
Negative Activating Emotion × Positive Family Expressiveness	0.01	0.17	0.36	−0.57*
Negative Activating Emotion × Gender	0.14	−0.03	0.3	−0.58**
Positive Family Expressiveness × Gender	0.07	−0.36	−0.11	−0.34
ΔR^2	<.01	.01	.01	.04**
Step 3				
Negative Activating Emotion	−0.44	−0.60†	−0.74*	0.06
Positive Family Expressiveness	−0.38	−0.48	−0.65*	−0.11
Gender (1 = Male, 2 = Female)	−1.78*	−1.44†	−1.62*	−0.76
Negative Activating Emotion × Positive Family Expressiveness	0.75	0.99*	1.03*	0.22
Negative Activating Emotion × Gender	1.71*	1.72*	1.70*	1.09
Positive Family Expressiveness × Gender	1.56*	1.30†	1.2	1.23†
Negative Activating Emotion × Positive Family Expressiveness × Gender	−1.60*	−1.78*	−1.45†	−1.72*
ΔR^2	.01*	.01*	.01†	.01*

Note. $^{\dagger}p < .10$. *$p < .05$. **$p < .01$.

who reported low and average levels of positive family expressiveness, the slopes were not significantly different from zero (low: $B = -0.01$, $SE = 0.02$, $p = .576$; average: $B = 0.01$, $SE = 0.02$, $p = .563$). At Wave 2, no significant relationship was observed between negative activating emotions and drawing creativity among

boys, regardless of the level of positive family expressiveness (*Bs* <0.02, $p > .067$). The slope for girls under low and average family expressiveness remained positive, albeit not reaching statistical significance (low: $B = 0.02$, $SE = 0.02$, $p = .195$; average: $B = 0.02$, $SE = 0.01$, $p = .174$).

Alternative uses task

For the second creativity assessment, AUT, we identified a significant interaction between negative activating emotion, positive family expressiveness, and gender at both Wave 1 ($\beta = -1.78$, $p = .022$) and Wave 2 ($\beta = -1.72$, $p = .027$). At Wave 1, a positive correlation between negative activating emotions and performance in the AUT was evident when boys reported high levels of positive family expressiveness ($B = 0.05$, $SE = 0.02$, $p = .032$). Conversely, no statistically significant slope was found among girls (see Figure 2a, *Bs* <0.027, $p > .203$).

At Wave 2, we observed a similar positive association between negative activating emotions and AUT in boys when they reported average ($B = 0.02$, $SE = 0.02$, $p = .014$) and high ($B = 0.06$, $SE = 0.02$, $p = .009$) positive family expressiveness (Figure 2b). Notably, a slope difference test (Dawson & Richter, 2006)

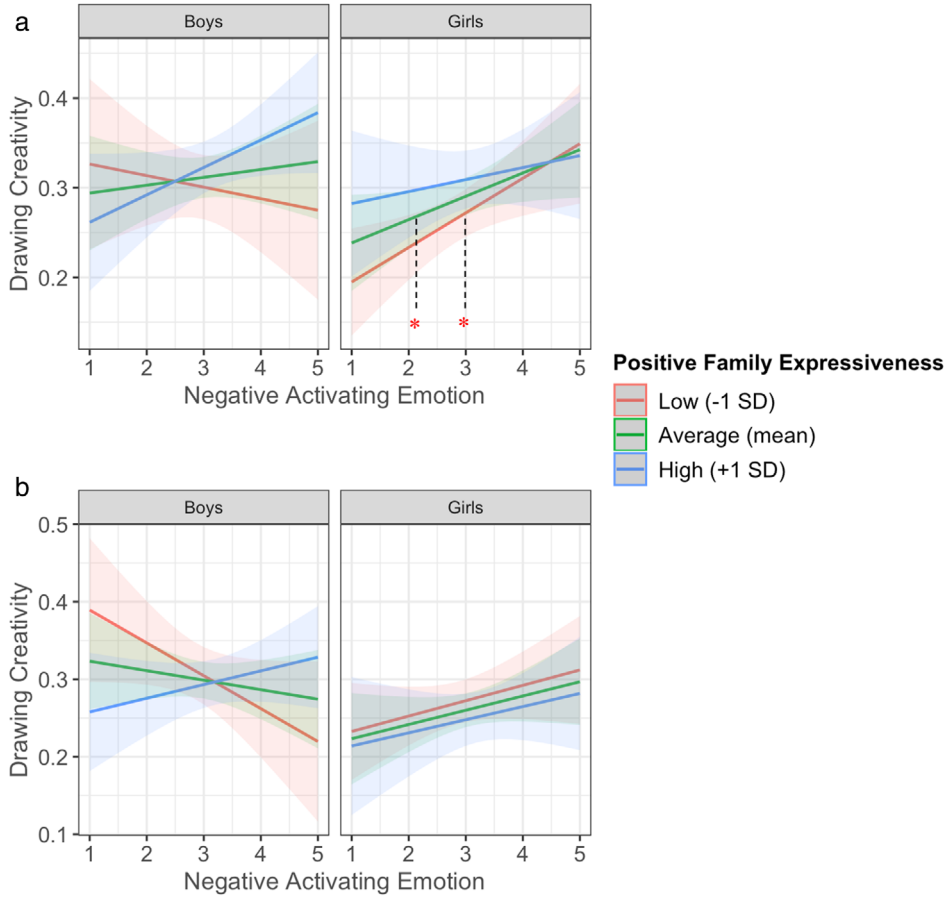

FIGURE 1. The moderating role of positive family expressiveness in the association between negative activating emotion and drawing creativity, with separate plots for boys and girls.*Note*. Panel a: The interaction effect observed at Wave 1. Panel b: The interaction effect observed at Wave 2. Asterisks denote slopes that were significantly different from zero. Shaded areas represent the 95% confidence intervals.

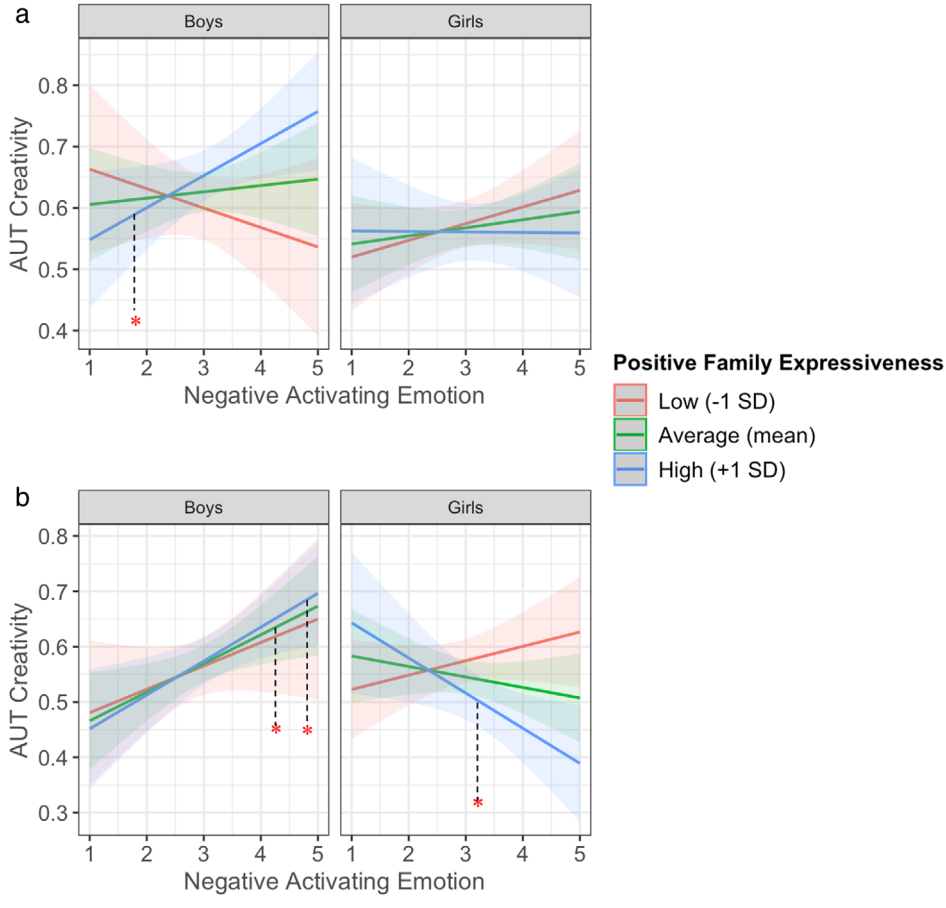

FIGURE 2. The moderating role of positive family expressiveness in the association between negative activating emotion and AUT creativity, with separate plots for boys and girls.*Note*. Panel a: The interaction effect observed at Wave 1. Panel b: The interaction effect observed at Wave 2. Asterisks denote slopes that were significantly different from zero. Shaded areas represent the 95% confidence intervals.

revealed a significant difference between boys and girls when high positive family expressiveness was reported ($t(339) = -3.50$, *Bonferroni* $p = .003$). The relationship between negative emotion and creativity was positive in boys, while such a relationship was negative in girls ($B = -0.06$, $SE = 0.03$, $p = .020$). A contrast test revealed that this negative association in girls was statistically different between high and low positive family expressiveness ($t(339) = -2.95$, *Bonferroni* $p = .020$).

Longitudinal analysis

To further examine the role of context and gender in the association between emotion and creativity, longitudinal regression analyses was conducted. These analyses were similar to the concurrent sets, with the exception that autoregressive variables were included to understand whether changes in creativity were explained by the interplay between negative activating emotion, family expressiveness, and gender.

Table 4 presents the results of the longitudinal regression analysis for drawing and AUT, respectively. In the case of drawing, with the exception of the autoregressive path (i.e., creativity drawing at Wave 1), no significant main or interaction effect was evident. For the AUT, there were no significant main or three-way

TABLE 4. Longitudinal Predictors of Creativity Expressed in Drawing and the Multiple Uses Tasks

Variables	Drawing	AUT
	β	β
Step 1		
Wave 1 Drawing/AUT Creativity	0.33***	0.58***
Negative Activating Emotion	0.03	−0.06
Positive Family Expressiveness	0.03	0.01
Gender (1 = Male, 2 = Female)	−0.10	0.05
Step 2		
Wave 1 Drawing/AUT Creativity	0.32***	0.58***
Negative Activating Emotion	−0.27	0.04
Positive Family Expressiveness	−0.19	0.24
Gender (1 = Male, 2 = Female)	−0.32	0.72**
Negative Activating Emotion × Positive Family Expressiveness	0.35	−0.12
Negative Activating Emotion × Gender	0.20	−0.08
Positive Family Expressiveness × Gender	0.03	−0.60**
ΔR^2	.01	.02*
Step 3		
Wave 1 Drawing/AUT Creativity	0.33***	0.57***
Negative Activating Emotion	−0.12	−0.12
Positive Family Expressiveness	−0.06	0.10
Gender (1 = Male, 2 = Female)	0.17	0.19
Negative Activating Emotion × Positive Family Expressiveness	0.15	0.10
Negative Activating Emotion × Gender	−0.32	0.48
Positive Family Expressiveness × Gender	−0.45	−0.07
Negative Activating Emotion × Positive Family Expressiveness × Gender	0.52	−0.56
ΔR^2	<.01	<.01

Note. $^{\dagger}p < .10$. $*p < .05$. $**p < .01$. $***p < .001$.

interaction effects of negative activating emotions. Perhaps surprisingly, a significant interaction effect was found between positive family expressiveness and gender in Step 2 ($B = -0.05$, $SE = 0.02$, $p = .002$). However, this interactive effect was not observed in Step 3. To further probe the two-way interaction, simple slope tests were conducted. No significant association between family expressiveness and AUT was found.

DISCUSSION

The current study examined the moderating roles of family expressiveness and gender in the associations between negative activating emotions and creativity in adolescents. Results revealed that the link between negative activating emotions and creative performance was qualified by positive family expressiveness and gender. Specifically, there was a positive association between negative activating emotions and creative drawing when girls reported low and average levels of family expressiveness. Negative activating emotions were associated with dampened creativity, as reflected in the AUT, when girls experienced high positive family expressiveness. When boys reported high positive family expressiveness, negative activating emotions were associated with enhanced creativity reflected in the AUT. These findings underscore the importance of considering gender and family context in investigating the complex relationship between emotion and creativity during adolescence.

EMOTION AND CREATIVITY

Prior research on the association between negative activating emotion and creativity has yielded mixed findings. Findings from the current study generally support the notion that negative activating emotion is conducive to creativity. However, variations across gender, assessment types, and assessment timing were also observed. In terms of timing-related variability, results from the current research indicated that negative activating emotion was related to creativity in drawing measured at the first, but not the second, timepoint

among girls. On the other hand, negative activating emotion was not associated with creative performance in drawing task among boys at both assessment time points. Regarding the AUT task, we found significant positive associations between negative activating emotion and their creative performance among boys, but not girls, at the second assessment time point.

Our study adds to the extant literature by demonstrating the importance of considering gender in the associations between negative activating emotion and creativity. Findings from the current research deviate from a study by Yeh, Lai, and Lin (2016), which indicated that frustration and anger were negatively related to game-based creativity, with no gender difference. However, it is important to note that the creativity measures included in the Yeh et al. (2016) study were based on a battery of insight tasks, while the current study relied on tasks that tap divergent thinking. Importantly, the tasks in Yeh et al. were inherently emotion-inducing, given that participants were cognizant of the time limits and impending feedback. In contrast, participants in the current study were oblivious about the purposes of the tasks, which may allow for an exploration of how emotional states influence creative performance without the added pressure of being evaluated. Additionally, the gender difference observed in our study did not replicate across waves.

FAMILY EXPRESSIVENESS AND GENDER AS MODERATING FACTORS

Notably, findings from the current research indicate that the associations between negative emotions and creativity depended on both family expressiveness and gender. Consistent with our hypothesis, a high level of positive family expressiveness strengthened the relationship between negative activating emotion and creativity in AUT among boys, highlighting the possible benefits of an emotionally expressive family environment. This finding is in line with research demonstrating the facilitating role of positive maternal expression in boys' uses of adaptive emotion regulation strategies and problem solving (Chen et al., 2018). A longitudinal study by Bronstein, Briones, Brooks, and Cowan (1996) showed that boys tended to express negative emotions, such as crying, when their family environments were more receptive of emotional expression. In turn, crying was associated with more optimal social and psychological adjustment in late adolescence for boys but poorer adjustment for girls (Bronstein et al., 1996). Therefore, an emotionally supportive family climate may be particularly beneficial for boys, such that their expression of negative emotions may be more effectively channeled to fuel creative endeavors.

In the current research, substantial variability across waves and tasks was observed among girls. Contrary to our expectations, a high level of positive family expressiveness weakened the associations between negative activating emotion and creativity in AUT at Wave 2. However, when girls reported experiencing low to average level of positive family expressiveness, negative activating emotion was positively associated with their drawing creativity at Wave 1. One plausible explanation for the discrepant patterns between boys and girls is that positive family expressiveness frequently co-occurs with the expression of negativity within the family (e.g., Gao & Han, 2016; Kyeong, Cheung, & Cheung, 2021; Ramsden & Hubbard, 2002). Negative emotional expressions within families, however, are associated with dampened emotion regulation skills in girls but not in boys (Chen et al., 2018; Denham et al., 1997; Ramsden & Hubbard, 2002). For example, Eisenberg et al. (1992) found that maternal negative emotions influenced emotional reactivity in girls to a greater extent than boys. Notably, while negative family expressiveness tended to result in lower emotion regulation skills in girls, such an association was not observed among boys (Ramsden & Hubbard, 2002). Thus, the dampening role of high positive family expressiveness in girls' ability to channel negative activating emotions into creativity found in the current research may stem from the co-occurrence of positive and negative emotional expressions within families. Nevertheless, it should be noted that the dampening role of positive expressiveness among girls was evident at Wave 2 only. Further research is needed to determine whether and how the co-occurrence of positive and negative emotions moderates the association between emotion and creativity.

Longitudinal associations

While our concurrent analysis revealed significant interactions between negative activating emotion, positive family expressiveness, and gender on creativity, there were no statistically significant three-way interactions evident in the longitudinal analysis. There are at least two explanations for such a finding. First, the lack of significant interaction effect might suggest that creativity, as reflected in creative drawing and AUT, is relatively stable over a six-month interval. As such, much of the variability in creativity at Wave 2 appears to have been adequately explained by the autoregressive path. Indeed, correlation analysis revealed that creative performance at Wave 1 was moderately to highly correlated with creative performance at Wave 2

(*r*s = .337 to .577). Therefore, the absence of a longitudinal replication, especially for the AUT, might partly result from the stability of creativity measured in the current study relative to the timeframe of data collection. Another possible explanation is that due to the brevity of the creativity tasks used in the current research, adolescents' creative potential may reflect their reactivity to the immediate environment, rather than a consequence of distal developmental factors.

CREATIVITY DEVELOPMENT BEYOND A WESTERN CULTURAL CONTEXT

The current research provided a unique perspective by using a sample from a non-Western country. Research has shown that East Asian culture is less likely to consider the experiences of positive emotions as a social norm compared to American culture (Eid & Diener, 2001). Consequently, positive family expressiveness is related to children's emotion regulation (Suveg et al., 2014) and the development of social anxiety (Morelen, Jacob, Suveg, Jones, & Thomassin, 2013) to a greater extent in Western cultures than in East Asian cultures. Nevertheless, the current study reveals that the positive expressions within families continued to produce benefits for boys in Japanese culture, suggesting the impact of an openly expressive climate in families is not negligible, even in cultures where open expressions of positive emotions are less commonplace.

Notably, although emotional expression tends to be more reserved among Japanese compared to North Americans (Matsumoto, Yoo, Hirayama, & Petrova, 2005; Safdar et al., 2009), men consistently express more powerful emotions (e.g., anger), fewer powerless emotions (e.g., fear) and fewer happiness than women in both regions (Safdar et al., 2009). This similarity implies that gender norms around emotional expression may be robust across different cultural contexts. Further research across diverse cultural settings is needed to determine whether gender differences in sensitivity to positive family expressiveness observed in current study are universal or significantly influenced by specific cultural practices and values.

LIMITATIONS AND FUTURE DIRECTIONS

Findings from the current research should be interpreted in light of several design features. First, the associations we found among emotion, family expressiveness, and creativity are correlational in nature. Therefore, cautions should be taken when explaining the results. Although extant literature on the mood-creativity link has primarily focused on the impact of emotion on creativity, a subset of research has examined how engagement in creativity activities can lead to changes in emotional experiences (e.g., Chiu et al., 2019). To further enhance our understanding of the nature of these relationships, future research may employ cross-lag designs to examine the direction of influences.

Second, the current study used creativity measurements (i.e., drawing task and AUT) designed to assess divergent thinking (Guilford, 1967; Torrance, 1966), given their widespread use in mood-creativity research (Baas et al., 2008). However, it should be noted that various other types of creativity measures are available, including insight tasks (De Dreu et al., 2008), activity checklists (Carson, Peterson, & Higgins, 2005), assessment of creative products (Besemer, 1998), among others. These measures have been found to differ from the divergent thinking assessments in the way they are influenced by emotion (Baas et al., 2008; Davis, 2009). For example, a contrast between positive and negative emotions showed that although negative emotions were associated with dampened fluency and originality, the impact of negative emotion on flexibility and performance in insight tasks is not as pronounced (Baas et al., 2008). Task duration should also be taken into consideration. Negative emotions such as dissatisfaction might not significantly impact creativity in short, controlled laboratory tasks. However, in real-world creative projects that span over longer periods, these emotions could play a crucial role (Lee, Nembhard, & Cleary, 2020). Thus, future studies should include more diverse types of creativity measurements to provide a better understanding of the generalizability of our findings.

Third, this study did not control for other sociodemographic factors beyond gender. The absence of a broader range of sociodemographic controls, such as socioeconomic status or educational background, might limit the generalizability of the findings (Jankowska, Lebuda, & Gralewski, 2024). Future studies might consider including a wider array of sociodemographic variables to better understand their potential moderating effects on the relationship between negative emotions and creativity.

Forth, longitudinal research spanning over a longer period of time (beyond 6 months) can further clarify the role of family expressiveness in creativity development. Considering verbal divergent thinking abilities remain relatively stable during adolescence (Kleibeuker, De Dreu, & Crone, 2013), incorporating more time points would allow for a more accurate evaluation of the trajectory of creative development (Barbot, 2019).

Additionally, this extended timeline would enable the examination of potential delayed effects of emotional experiences and family climate on creativity.

CONCLUSIONS

Among early adolescents, negative activating emotions may fuel their creative expression (e.g., creative drawing and divergent thinking), with positive family expressiveness and gender playing crucial roles in shaping the strength of this relationship. Negative activating emotion tended to be associated with creativity among girls, especially when their family environment is characterized by low or average levels of emotional expressivity. For boys, their creativity thrives in an emotionally positive and supportive family environment as they experience heightened negative activating emotions. Overall, our findings highlight the importance of considering the role of family dynamics and gender to understand the relationship between emotions and creativity.

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CONFLICT OF INTEREST

We have no known conflict of interest to disclose.

ETHICS STATEMENT

The study was approved by the Institutional Review Board at the Kyoto University.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available in Dryad at https://doi.org/10.5061/dryad.wwpzgmsr3 (The dataset has not been made public thus far. For review purpose, please use the link below to access the dataset: https://datadryad.org/stash/share/PsEJzqH9qKf7lG0IgFR9R5O6qbxA3AuYWA7Z_0F6-38).

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Appendix S1. Creativity tasks (Drawing).
Appendix S2. Summary of fit indices and model comparisons for the measurement invariance analysis.