



## Research article

# Affect under need satisfaction and need thwarting: A new classification for the prediction of creative performance

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## ARTICLE INFO

**Keywords:**

Affect  
Creative performance  
Self-determination theory

## ABSTRACT

Affect plays a pivotal role in fostering creative performance, and there is increasing recognition that different levels and types of affect may exert distinct impacts on creative performance. Drawing upon self-determination theory, this study aims to explore a novel classification of affect—*affect under need satisfaction and need thwarting*—and examine its relationship with creative performance. Study 1 involved 75 participants to investigate the content of affect under need satisfaction and need thwarting. Study 2 explores the relationship between affect and creative performance using a sample of 115 employees from Beijing. The findings unveiled nine types of affect under need satisfaction (e.g., moderate levels of excited) and eleven types of affect under need thwarting (e.g., low levels of afraid). Positive associations were observed between affect under need satisfaction and creativity, while negative associations were found between affect under need thwarting and creativity. Empirical evidence corroborating the significant role of the new classification of affect in enhancing employee creativity within the context of Chinese academia and researchers is presented.

## 1. Introduction

Organizations rely on creativity to navigate the fast-paced, ever-changing, and uncertain operational landscape driven by globalization, rapid technological innovation, and heightened competition [1,2]. Recognizing the significance of creativity in organizations, extensive research efforts have been dedicated to exploring the antecedents of individual creativity, predominantly from cognitive, motivational, and emotional standpoints [3–5]. Studies focusing on the emotional perspective have underscored affect as a pivotal determinant influencing individual creativity [6]. Recent research suggests that different types of affect may exert distinct influences on creative performance [7,8], contributing to the burgeoning literature on affect and creative performance [9,10].

Previous research has explored the relationship between affect and creative performance, yet two fundamental issues remain unresolved. Firstly, there is no consensus regarding the differing impacts of positive versus negative affect on creativity performance

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[11]. While some studies suggest that a positive emotional state enhances creativity [12–14], others propose that a negative emotional state fosters greater creativity [15,16]. However, the literature lacks consensus on the nature of the relationship between affect and creative performance.

Secondly, some studies argue that besides valence (positive vs. negative), the arousal level of affect is crucial [17,18], yet findings have been inconsistent. Amabile suggests a U-shaped relationship between affect and creativity, positing that intense negative or positive affect enhances creativity, while moderate levels may not sufficiently stimulate cognitive resources [19]. However, James et al. propose an inverted U-shaped function for the affect-creativity relationship [20]. Despite establishing a link between affect and creativity, the nature of this relationship remains unclear.

In addressing these research gaps, this study draws upon Self-determination theory (SDT) and explores a new classification of affect to elucidate its impact on creativity performance [21]. SDT, a well-known and widely applied theory in psychology and motivation [22], is grounded in the concept of three basic psychological needs—autonomy, relatedness, and competence [21]. Research by Debjani et al. indicated that tasks involving novelty and challenge fulfill these innate psychological needs, thus fostering creativity [23]. Additionally, studies have shown that need satisfaction is a better predictor of positive feelings such as positive affect and vitality, whereas need frustration is a better predictor of negative feelings like negative affect and burnout [24,25].

In the present research, guided by the principles of SDT, we propose the concept of affect under need satisfaction and need thwarting, aiming to explore the nuances of affective experiences based on valence and arousal level. Affect under need satisfaction emerges when an individual's intrinsic needs are supported within an environment conducive to autonomy, fostering positive work behavior and creative performance. Conversely, affect under need thwarting arises when an individual's autonomy is compromised within a controlling environment, potentially impeding their work behavior and creative output. Recent evidence suggests that creative performance in the workplace cannot be fully captured by a simple positive-negative affect framework alone. By delineating this novel affective classification, we aim to enhance our understanding of the psychological mechanisms underlying affect and potentially uncover pathways to enhance creativity. Therefore, this study investigates the constituents of affect under need satisfaction and need thwarting and examines their impact on creative performance.

## 2. Affect and creative performance

Affect, recognized as one of the most influential factors affecting creative performance, holds significant importance in creative endeavors [26,27]. Affect refers to an individual's subjective response to external stimuli, encompassing physiological arousal, subjective experience, and outward behavior [28]. Watson and Tellegen categorized affective experiences into unrotated dimensions, such as arousal level, and varimax-rotated components, including positive affect and negative affect [29]. This comprehensive understanding of affective structure provides valuable insights into its role in shaping creative outcomes.

The influence of positive and negative affect on creative performance lacks consistency across current studies, leading to ongoing debate and uncertainty. Some research findings suggest that positive affect states tend to enhance creativity more effectively than negative affect states [12,30,31]. Positive affect has been associated with improved problem-solving efficiency and enhanced cognitive flexibility, thereby fostering individual creativity [32]. Conversely, contrasting studies propose that negative affect may actually stimulate greater creative performance compared to positive affect [15,16,33]. Despite numerous investigations into this matter, a consensus has yet to be reached, highlighting the complexity of the relationship between affect and creative outcomes.

Studies examining the association between affect and creative performance from the perspective of arousal yield conflicting results. Zenasni and Lubart propose that highly heightened negative affect can hinder the generation of novel ideas [18]. Conversely, Talarico et al. suggest a U-shaped relationship, wherein intense negative or positive affect fosters creativity, while moderate levels of affect may not sufficiently stimulate the cognitive resources required for creativity [34]. De Dreu et al. demonstrate that activating moods, such as anger or happiness, lead to greater creativity compared to deactivating moods [17]. Despite the inconsistencies in findings across these studies, the collective evidence suggests that emotional arousal may indeed benefit creativity.

## 3. Inspiration from self-determination theory

This study leverages Self-determination theory (SDT) to elucidate how affect influences creative performance [21]. According to SDT, the contextual variable of autonomy support fosters the integration of rules and values, as well as basic psychological needs [21]. SDT delineates the environment into informational and controlling contexts [35]. Informational contexts are perceived as supportive of autonomy and promote or signify competence, thereby enhancing intrinsic motivation and individual behavior. In contrast, controlling contexts exert pressure toward specific outcomes, undermining intrinsic motivation and constraining individual behavior [21]. SDT is also based on the premise that humans possess innate psychological needs, including the needs for autonomy, competence, and relatedness, which serve as the underlying mechanism linking affect and creativity [21]. The need for autonomy pertains to the desire to feel psychologically free to engage in activities, competence involves the aspiration to feel effective in interactions with the environment, and relatedness encompasses the wish to feel connected to others [21]. SDT posits that a social environment that supports or thwarts these basic psychological needs can predict one's positive or negative psychological experiences, respectively [21].

The absence of need satisfaction does not always imply that the need has been frustrated or thwarted. This distinction is crucial in understanding the complexities of human motivation and behavior. Need satisfaction refers to the fulfillment of innate psychological needs, such as autonomy, competence, and relatedness, which are essential for optimal functioning and well-being [21]. However, the mere absence of need satisfaction does not automatically indicate that the need has been actively thwarted or frustrated. Thwarting of needs occurs when external or internal factors actively obstruct or undermine individuals' efforts to satisfy their innate needs [36]. For

example, in a work context, an employee may have the opportunity to make autonomous decisions (satisfying the need for autonomy), but if their decisions are constantly overridden by a micromanaging supervisor, their need for autonomy may be thwarted. Similarly, frustration of needs involves the inability to fulfill one's needs due to external constraints or barriers [37]. Understanding the nuances between need satisfaction, thwarting, and frustration is critical for designing interventions and creating environments that support individuals' well-being and optimal functioning. Research in this area has highlighted the importance of fostering environments that facilitate need satisfaction while minimizing instances of need thwarting or frustration [38]. By elucidating these distinctions, researchers can gain deeper insights into the factors that contribute to human motivation, behavior, and overall psychological health.

Several studies have established correlations between basic psychological needs and affect. Ryan et al. argue that the fulfillment of basic psychological needs is closely associated with positive affect, energy, and self-esteem, while being less linked to negative affect or physiological disorders [39]. Eddie et al. illustrate that competence and relatedness needs exhibit negative associations with anger and sadness, positive associations with joy, and weaker associations with guilt and shame [40]. Furthermore, certain findings indicate that need satisfaction more accurately predicts positive emotions such as positive affect and vitality, whereas need frustration more accurately predicts negative emotions like negative affect and burnout [24,25].

With increasing consensus among academics, it is becoming apparent that context is likely to influence the various impacts of mood states [41]. Therefore, solely examining the relationship between affect and creativity within a specific background and environmental condition may lead to more stable conclusions. Self-determination theory posits that emotions serve as informational inputs crucial for guiding action and growth [35]. According to SDT logic, positive and negative affect may either facilitate or impede creative performance, contingent upon the environment. This approach elucidates how environmental cues influence signals, thereby proposing a novel classification of affect to attain a comprehensive, integrated understanding of the relationship between affect and creative performance.

#### 4. The present study

Based on SDT, the fulfillment of three basic psychological needs can be considered outcomes of individual environmental evaluations [21]. Need supportive environments foster more sense of safety and freedom, and thus should be associated with more positive affect, and be likely to facilitate more creative engagement [42]. Conversely, need thwarting environments, (e.g., controlling contexts) are expected to generate greater negative affect, and thereby inhibit creative outputs. Therefore, affect under need satisfaction promotes creativity, while affect under need thwarting inhibits it.

The existing evidence suggests that an informational environment satisfying innate psychological needs leads to positive affect, while a controlling environment hindering these needs results in negative affect. However, without considering the arousal level of affect, we cannot definitively categorize affect under need satisfaction as positive and affect under need thwarting as negative. Research on affect arousal level and creative performance indicates that moderate levels of affect facilitate creative performance more effectively, while low arousal levels may lead to inactivity, avoidance, and reliance on dominant responses rather than innovative ones [34]. Conversely, extremely high arousal levels can impair an individual's ability to process information effectively. Individuals with moderate arousal levels are more likely to seek and integrate information and consider multiple alternatives. Building on this, our study proposes a new affect classification, combining affective valence with arousal level: affect under need satisfaction and affect under need thwarting. We hypothesize the following.

**Hypothesis 1.** Affect under need satisfaction occurs when the three basic psychological needs are met, primarily characterized by positive affect with a moderate arousal level. Conversely, affect under need thwarting occurs when the three basic psychological needs are minimally satisfied, primarily characterized by negative affect with a low or high arousal level.

According to SDT, there are no inherently good or bad emotions as all emotions serve specific and essential functions [21]. SDT posits that one's positive or negative psychological experiences and outcomes can be predicted based on whether their basic psychological needs are supported or hindered [21,43]. Need satisfaction is crucial for fostering affect under need satisfaction, well-being, and growth, while need frustration contributes to affect under need thwarting, ill-being, and pathology [44,45], ultimately influencing creative performance. Hence, we propose the following hypothesis.

**Hypothesis 2.** Affect under need satisfaction is positively related to creative performance, and affect under need thwarting is negatively related to creative performance.

#### 5. Method

##### 5.1. Study 1

Given the significance of creativity in the workplace, affect stands out as one of the most widely utilized indicators of creative performance [46]. However, inconsistent findings have emerged regarding the relationship between workplace affect and creative performance. Study 1 aims to delve into the content of affect under need satisfaction and need thwarting to elucidate how affect influences creative performance.

##### 5.1.1. Participants

The participants for this study consisted of 114 individuals from 6 companies located in Beijing, Jiangsu, and Zhejiang. After excluding survey responses with consistent and/or missing answers, we obtained 75 valid surveys for analysis, resulting in an effective

return rate of 66 %. Among the participants, 35 were men (47 %) and 40 were women (53 %). Regarding educational qualifications, 65 participants (87 %) held a college degree or higher academic qualification, while 10 participants (13 %) did not possess a college degree. In terms of age distribution, 66 participants (88 %) were between the ages of 20 and 35 years, and 9 participants (12 %) were between the ages of 35 and 60 years. Additionally, 35 participants (47 %) had less than 3 years of service, 32 participants (43 %) had 3–10 years of service, and 8 participants (10 %) had more than 10 years of service.

### 5.1.2. Measures

We employed the Basic Psychological Needs Scales (BPNS) [47] and the Positive and Negative Affect Scales (PANAS) [48] to assess affect under need satisfaction and need thwarting. The BPNS scale comprises 21 items distributed across three dimensions: autonomy (7 items), competence (6 items), and relatedness (8 items). Notably, the BPNS scale used in this study exclusively includes satisfaction items, with no frustration items present. Therefore, we designated the reverse items within the satisfaction items as indicators for thwarting. Conversely, the PANAS scale consists of 20 items categorized into two dimensions: positive affect (10 items) and negative affect (10 items). We adapted the positive items in the BPNS scale across the autonomy, competence, and relatedness dimensions to measure affect under need satisfaction (e.g., “When my feelings are taken into consideration at work, I feel \_\_\_”; “When I have been able to learn interesting new skills on my job, I feel \_\_\_”; “When I consider the people I work with to be my friends, I feel \_\_\_”). Similarly, we adjusted the reverse items in the BPNS scale across the autonomy, competence, and relatedness dimensions to assess affect under need thwarting (e.g., “When there is not much opportunity for me to decide for myself how to go about my work, I feel \_\_\_”; “When I am working and often do not feel very capable, I feel \_\_\_”; “When the people I work with do not seem to like me much, I feel \_\_\_”). Additionally, we utilized 20 affective states (e.g., interested, excited, irritable, alert) from the PANAS to measure affective states [48]. Respondents were asked to indicate how they had felt at work under specific autonomy-supportive or controlling events. Items were rated on a 5-point Likert scale ranging from 1 = never to 5 = always. The questionnaire comprised 20 × 21 choices. Each event was repeated 10 times for either positive or negative affect. We calculated Cronbach alphas for both positive and negative affect dimensions for each of the 21 situations, resulting in a total of 42 Cronbach alphas values. Table 1 displays the average Cronbach alphas values for positive and negative affect dimensions across the 21 situations of need satisfaction and need thwarting.

### 5.1.3. Procedure

All measurements were conducted in Chinese, despite the original constructs of affect, basic psychological needs, and creative performance being designed in English. To ensure accurate translation, we employed the back-translation method [49]. In this process, one linguistics specialist translated the English text into Chinese, and another linguistics specialist reversed the process. Any discrepancies between the two English versions were reconciled by adjusting the Chinese version until no semantic differences remained. Subsequently, we enlisted the expertise of psychologists to review the Chinese scales. Before finalizing the questionnaire, academic experts assessed its adequacy and suitability. Following expert clearance, the authors distributed the questionnaire to participants during a group discussion before they submitted their responses. In the process of distributing the questionnaires, we presented the ethical approval of the study to the participants and obtained verbal consent from each of them. All participants were informed of their right to withdraw from the survey at any time. As all participants were employees of the company, there were no minors involved.

### 5.1.4. Results

We assessed the specific types of affect that were most commonly experienced in autonomy-supportive and controlling events. The study extracted the frequency of each affect in these events, and the results are presented in Table 2.

We employed the Euclidean distance clustering method to classify the affective variables [50,51]. For the clustering analysis, we utilized the frequency of each type of affect as “not chosen 1”, employing the longest distance method. The class labels derived from the longest distance are presented in Table 3: “1-gauge” denotes the first group, and “2-gauge” denotes the second group.

We facilitated discussions among experts in the field to interpret the results. Drawing on previous literature reviews, it is established that individuals predominantly experience positive affect when their basic psychological needs are satisfied, whereas when these needs are thwarted, individuals mainly experience negative affect. According to the statistical results obtained from the cluster analysis conducted in the current study, the first group of affect (excited, enthusiastic, proud, interested, attentive, inspired, determined, strong, and active) primarily comprises positive affect, while the second group (irritable, upset, distress, jittery, afraid, nervous, hostile, ashamed, guilty, alert, and scared) mainly consists of negative affect. According to hypothesis 1: Affect under need satisfaction occurs when the three basic psychological needs are met, primarily characterized by positive affect with a moderate arousal level. Conversely, affect under need thwarting occurs when the three basic psychological needs are minimally satisfied, primarily characterized by negative affect with a low or high arousal level. Thus, the emotions in the first group are identified as affect under need satisfaction, while those in the second group are identified as affect under need thwarting.

**Table 1**  
Cronbach’s alphas.

Events	Dimensions	Average Cronbach alphas
Basic psychological needs satisfaction	Positive affect	0.83
	Negative affect	0.85
Basic psychological needs frustration	Positive affect	0.90
	Negative affect	0.87

**Table 2**  
The frequencies of affect under need satisfaction and need thwarting.

Variables	Basic psychological needs satisfaction			Basic psychological needs frustration		
	Choose 1 (the emotion is aroused)	Don't choose 1 (the emotion is not aroused)	Total	Choose 1 (the emotion is aroused)	Don't choose 1 (the emotion is not aroused)	Total
Excited	51	849	900	535	140	675
Irritable	871	29	900	334	341	675
Upset	867	33	900	199	476	675
Distress	875	25	900	254	421	675
Jittery	833	67	900	330	345	675
Afraid	852	48	900	428	247	675
Nervous	749	151	900	300	375	675
Hostile	862	38	900	497	178	675
Enthusiastic	89	811	900	470	205	675
Proud	127	773	900	572	103	675
Interested	158	742	900	506	169	675
Attentive	191	709	900	388	287	675
Ashamed	729	171	900	582	93	675
Inspired	143	757	900	532	143	675
Determined	228	672	900	426	249	675
Guilty	854	46	900	481	194	675
Alert	772	128	900	422	253	675
Strong	117	783	900	408	267	675
Active	93	807	900	435	240	675
Scared	863	37	900	457	218	675

Note, N = 75.

**Table 3**  
Result of the cluster analysis on affect.

Variables	Affect under need satisfaction	Affect under need thwarting
Excited	1	2
Irritable	2	1
Upset	2	1
Distress	2	1
Jittery	2	1
Afraid	2	1
Nervous	2	1
Hostile	2	2
Enthusiastic	1	2
Proud	1	2
Interested	1	2
Attentive	1	1
Ashamed	2	2
Inspired	1	2
Determined	1	1
Guilty	2	2
Alert	2	1
Strong	1	1
Active	1	1
Scared	2	2

Note, N = 75.

**Table 4**  
Arousal Level of affect under need satisfaction.

Variables	Choose 2	Choose 3	Choose 4	Choose 5	Not choose 1 ( total )	The average of arousal level	Arousal intensity
Excited	116	228	263	242	849	3.74	Moderately
Enthusiastic	126	253	259	173	811	3.59	Moderately
Active	116	224	285	182	807	3.66	Moderately
Strong	104	233	269	177	783	3.66	Moderately
Proud	147	235	234	157	773	3.52	Moderately
Inspired	119	230	236	172	757	3.61	Moderately
Interested	143	223	222	154	742	3.52	Moderately
Attentive	142	231	192	144	709	3.48	Moderately
Determined	118	215	199	140	672	3.54	Moderately

Note, N = 75.

Weighted averages refer to a method of computing the mean of a set of numbers where each number is multiplied by a pre-determined weight before being added together [52]. Based on previous research [53,54], we used weighted averages to calculate the intensity level of affect under need satisfaction and need thwarting in our study. Specifically, we assigned weights to each level of affect intensity (ranging from 2 to 5) and then calculated the average intensity level based on these weights. The scores ranging from 2 to 5 were categorized into four groups: a score of 2–2.75 indicates a low level; a score of 2.76–3.50 suggests a slight level; a score of 3.51–4.25 reflects a moderate level; and a score of 4.26–5 signifies a high level. The findings regarding the intensity level of affect under need satisfaction and need thwarting, categorized into four groups based on scores ranging from 2 to 5, are presented in Tables 4 and 5.

In Tables 4 and 5, there is a clear distinction in the emotional intensity levels between affect under need satisfaction and need thwarting. The majority of affect under need satisfaction corresponds to moderate levels of positive emotions, while most of the affect under need thwarting aligns with low and slight levels of negative emotions. Only a small proportion of items in affect under need thwarting are categorized as slight levels of positive emotions. The distribution of affect types is depicted in Fig. 1.

The results of Study 1 indicate that when needs are satisfied, individuals predominantly experience moderate levels of positive affect such as excited, enthusiasm, proud, inspired, interested, attentive, determined, strong, and active. We categorize these as affect under need satisfaction. Conversely, when needs are thwarted, individuals tend to experience slight arousal levels of affect including irritable, upset, distress, jittery, afraid, nervous, hostile, ashamed, guilty, alert, and scared. We label these as affect under need thwarting. The majority of affect under need satisfaction corresponds to moderate levels of positive emotions, while most of the affect under need thwarting aligns with low and slight levels of negative emotions. It was observed that affect under need thwarting encompasses not only negative but also positive emotions, albeit at slight levels. These findings align with prior research indicating that Asians often exhibit a tendency towards less overt expression of negative emotions [55]. Consequently, the arousal level of affect under need thwarting is notably lower than that of affect under need satisfaction. Therefore, Hypothesis 1 receives partial support.

## 5.2. Study 2

To examine the content of affect under need satisfaction and need thwarting, we explored the relationship between these two types of affect and creative performance in Study 2.

### 5.2.1. Participants

Using a convenience sampling method, we selected 132 employees and their supervisors from eight new venture capital companies operating in Beijing, Chongqing, and Sichuan as our participants. After eliminating survey responses with consistent and/or missing answers, we obtained 115 valid surveys for analysis, resulting in an effective return rate of 87 %. Of these, 41 were men (36 %) and 74 were women (64 %). Regarding educational qualifications, 15 participants (13 %) did not possess a college degree, 89 participants (77 %) held a college degree, and 11 participants (10 %) held a bachelor's degree. In terms of age distribution, 66 participants (57 %) were under 30 years old, and 49 participants (43 %) were 30 years old or older. Additionally, 73 participants (64 %) had less than 5 years of service, 33 participants (29 %) had 5–10 years of service, and 9 participants (7 %) had more than 10 years of service.

### 5.2.2. Measures

Affect under need satisfaction and need thwarting were measured using the results of the two types of affect identified in Study 1. The scale comprises 20 items divided across two dimensions: affect under need satisfaction (9 items) and affect under need thwarting (11 items). Responses were rated on a 5-point Likert scale ranging from 1 = never to 5 = always. A higher score indicates a higher frequency of affect under need satisfaction and need thwarting. Each dimension's score was summed to calculate the total affect score. Sample items include "moderate levels of excitement" (affect under need satisfaction) and "slight levels of upset" (affect under need thwarting). The Cronbach's alpha for affect under need satisfaction was 0.88, and for affect under need thwarting, it was also 0.88.

We evaluated creativity using supervisor ratings from the Creativity Performance Measure (CPM) [56]. Each employee was assessed by their supervisor using a 13-item scale, with sample items such as "Suggests new ways of performing work tasks." Responses

**Table 5**

Arousal Level of affect under need thwarting.

Variables	Choose 2	Choose 3	Choose 4	Choose 5	Not choose 1 ( total )	The average of arousal level	Arousal intensity
Upset	193	143	88	52	476	3.00	Slightly
Distress	171	116	89	45	421	3.02	Slightly
Nervous	204	93	50	28	375	2.74	Low
Jittery	167	91	55	32	345	2.86	Slightly
Irritable	186	87	31	37	341	2.76	Slightly
Attentive	92	104	48	43	287	3.15	Slightly
Strong	113	86	38	30	267	2.94	Slightly
Alert	129	70	32	22	253	2.79	Slightly
Determined	102	75	31	41	249	3.04	Slightly
Afraid	133	61	34	19	247	2.75	Low
Active	115	64	34	27	240	2.89	Slightly

Note, N = 75.

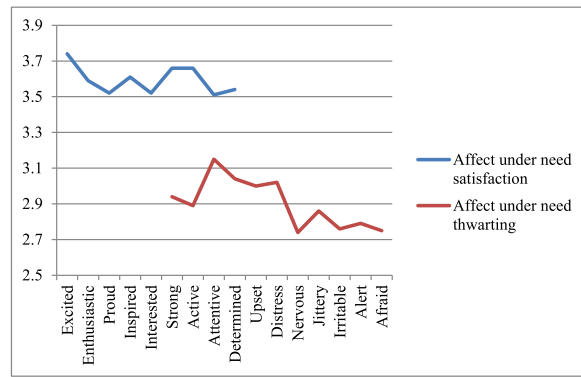


Fig. 1. Distribution map of affect arousal level under need satisfaction and need thwarting.

to the 13 items were rated on a scale ranging from 1 = not at all characteristic to 5 = very characteristic. The internal reliability of the CPM for this study was 0.71.

5.2.3. Procedure

The English scales were translated into Chinese, and the procedure for all scales was consistent with that of Study 1.

5.2.4. Results

The means, standard deviations, and correlations of the main variables are presented in Table 6. After controlling for gender, age, education, and years of work experience, the correlation results of each variable are shown in Table 6.

In Table 6, the results indicate a positive correlation between affect under need satisfaction and creative performance ( $r = 0.39, p < 0.01$ ), whereas affect under need thwarting is negatively correlated with creative performance ( $r = -0.47, p < 0.01$ ). Furthermore, affects under need satisfaction were all positively correlated with creativity performance, while those under need thwarting were all negatively correlated. These results partially validate the classification method in Table 3.

The study investigated whether creative performance could be predicted by affect under need satisfaction and need thwarting. Creative performance scores were simultaneously regressed onto these two variables, while controlling for gender. Table 7 illustrates that the regression model explains approximately 27 % of the variance in creative performance. The model was significant ( $F [3, 111] = 13.88, p < 0.001$ ). The results indicate that significant, independent variance in creative performance was explained by both affect under need satisfaction ( $\beta = 0.24, p < 0.001$ ) and affect under need thwarting ( $\beta = -0.35, p < 0.001$ ). Thus, hypothesis 2 was supported.

6. Discussion

In the organizational environment, comprehending employees' emotions, thoughts, and affect can assist managers in implementing effective measures to enhance employees' creative performance [57]. While existing research has offered valuable insights into the influence of emotions on creativity [1], there have been inconsistent findings regarding the relationship between workplace affect and creative performance. To address this gap, we developed and tested a classification system to elucidate whether an individual's affect

Table 6  
Correlations of variables.

Variables	M	SD	13	Variables	M	SD	13
1. Moderate levels of excited	3.30	0.90	0.17 <sup>a</sup>	1. Slight level of irritable	2.38	1.01	-0.37 <sup>b</sup>
2. Moderate levels of strong	3.38	0.86	0.25 <sup>b</sup>	2. Slight level of upset	2.43	1.02	-0.36 <sup>b</sup>
3. Moderate levels of active	3.43	0.96	0.33 <sup>b</sup>	3. Slight level of attentive	2.34	0.87	-0.35 <sup>b</sup>
4. Moderate levels of enthusiastic	3.52	0.95	0.27 <sup>b</sup>	4. Low level of afraid	1.85	1.00	-0.24 <sup>a</sup>
5. Moderate levels of interest	3.47	0.86	0.33 <sup>b</sup>	5. Slight level of determined	2.08	0.98	-0.28 <sup>b</sup>
6. Moderate levels of attentive	3.37	0.82	0.21 <sup>a</sup>	6. Slight level of strong	2.19	1.01	-0.45 <sup>b</sup>
7. Moderate levels of inspired	3.23	0.99	0.31 <sup>b</sup>	7. Slight level of distress	1.87	1.02	-0.41 <sup>b</sup>
8. Moderate levels of proud	2.99	0.92	0.23 <sup>a</sup>	8. Slight level of jittery	1.83	0.92	-0.19 <sup>a</sup>
9. Moderate levels of determined	3.53	0.91	0.38 <sup>b</sup>	9. Low level of nervous	2.29	0.93	-0.24 <sup>a</sup>
10. Affect under need satisfaction	30.23	5.79	0.39 <sup>b</sup>	10. Slight level of alert	2.63	0.98	-0.20 <sup>a</sup>
13. Creative performance	41.43	5.05	1	11. Slight level of active	2.32	0.89	-0.39 <sup>b</sup>
				12. Affect under need thwarting	24.21	7.18	-0.47 <sup>b</sup>

Note, N = 115.

<sup>a</sup>  $p < 0.05$ .

<sup>b</sup>  $p < 0.01$ .



**Table 7**  
Regression analysis results.

Variables	Creative Performance		
	$\beta$	t	Sig.
Gender	-0.10	-1.21	0.23
Affect under need satisfaction	0.24	2.63**	**
Affect under need thwarting	-0.35	-3.88**	**
R <sup>2</sup>	0.27		

Note, N = 115, \*p < 0.05, \*\*p < 0.01.

serves as a significant catalyst for creativity, and we explored the affective factors that may amplify this association. This study contributes to the understanding of affect and creativity in the following manners.

Firstly, we delved into the nature of affect under need satisfaction and need thwarting. As revealed in Study 1, we identified the constituents of affect under need satisfaction and need thwarting. Affect under need satisfaction encompassed emotions characterized by moderate arousal levels of excited, enthusiastic, proud, inspired, interested, attentive, determined, strong, and active. Conversely, affect under need thwarting comprised emotions typified by slight levels of upset, distress, jittery, irritable, attentive, strong, alert, determined, active, and low levels of nervous and afraid. These findings are consistent with prior research. According to extensive literature, the presence of positive affect enhances the likelihood of generating novel and effective ideas [26,58]. Positive affect fosters heightened creativity by stimulating cognition and enhancing cognitive flexibility [17]. While most studies either report a negative or null association between negative affect and creativity [26], our investigation aligns with this trend: a predominance of positive affect under need satisfaction and negative affect under need thwarting. The current study lends support to a linear relationship between affect under need satisfaction and creativity: the greater the frequency of positive events experienced by participants and the higher their levels of positive affect, the greater their creative performance.

We contend that accounting for affective arousal levels is crucial to reconcile inconsistent findings. The majority of affect under need thwarting comprises negative emotions with slight and low arousal levels, while a few types exhibit positive emotions with moderate arousal levels. Our results suggest that negative affects impede creative performance when they possess slight or low arousal levels. An intriguing observation is the presence of attentive, strong, determined, and active emotions on both lists of affect under need satisfaction and need thwarting. This implies that these four types of affect may either facilitate or hinder creative performance depending on their arousal levels. They constitute affect under need satisfaction when experienced at a moderate arousal level, whereas they represent affect under need thwarting when experienced at a slight or low arousal level. Consequently, our findings suggest that creative performance is enhanced when individuals exhibit moderate arousal levels of strong, active, attentive, and determined affects during creative activities, whereas creative performance is hindered when these affects are experienced at low or slight arousal levels.

As we delve into the complexities of contemporary Self-Determination Theory (SDT) research, the nuanced exploration of need frustration and satisfaction emerges as a pivotal focal point. Need frustration occurs when individuals perceive impediments or hindrances to fulfilling their basic psychological needs, such as autonomy, competence, and relatedness. Conversely, need satisfaction reflects the fulfillment of these needs, fostering optimal functioning and well-being. Recent studies in the SDT domain have unveiled subtle interplays between need frustration and satisfaction, emphasizing their significance across various outcomes, including creative performance. In our discussion, we will delve into the latest findings and theoretical insights from the SDT literature, elucidating the importance of need frustration and satisfaction in fostering creativity and promoting positive outcomes in organizational settings.

Secondly, we established a positive relationship between affect under need satisfaction and individual creative performance, while finding a negative relationship between affect under need thwarting and individual creative performance, as anticipated. Study 2, utilizing a distinct sample, corroborated these findings. Our results resonate with prior research indicating that individuals exhibit positive outcomes such as joy, self-assurance, mental well-being, self-fulfillment, and reduced negative affect when their basic psychological needs are extensively met [39]. However, it is not universally true that all forms of positive affect invariably enhance creative performance. Kaufmann and Vosburg contend that certain types of positive affect might actually impede creative performance [58]. We identified four types of positive affect that may diminish creative performance when experienced at slightly low arousal levels. Conversely, individuals encountering low levels of satisfaction in their basic psychological needs tend to experience negative affect, including diminished self-confidence, feelings of vulnerability, compromised health, lack of vitality, doubt, anger, and fear [39]. Thus, this study contributes to the literature on creativity by illustrating that affect under need satisfaction and need thwarting serve as potent predictors of creative performance.

## 7. Practical implications

The present research offers several practical implications worth considering. Firstly, it highlights the significance of affect associated with need satisfaction and need thwarting in enhancing creativity. Many managers grapple with effectively harnessing emotional dynamics within their management approaches to bolster creative performance. Therefore, gaining a clear understanding of which emotions facilitate or impede creative performance is pivotal for effective organizational management. Employees may experience affect under need satisfaction, fostering creativity, or affect under need thwarting, hindering creativity. Affect regulation plays a crucial role in this integration and in maintaining an adaptive balance between positive and negative affect [59]. Moreover,



given that individuals may encounter varied challenges in enhancing their creativity based on how they regulate affect [28], managers should assist employees in regulating affect to promote affect under need satisfaction while minimizing occurrences of affect under need thwarting.

Secondly, our analysis underscores an important consideration regarding the benefits of affect under need satisfaction. Our study suggests that managers can bolster employee creativity by nurturing the fulfillment of three basic psychological needs. Leaders can cultivate a socially supportive work environment that addresses employees' fundamental psychological needs. This fosters affect under need satisfaction and cultivates creativity. Thus, with a focus on effectively fostering affect under need satisfaction to enhance creativity, endeavors aimed at nurturing employees' three basic psychological needs emerge as an effective strategy.

## 8. Limitations and suggestions for future research

Despite the comprehensive analysis and insightful discussions presented in this study, it is essential to acknowledge several limitations that warrant consideration in interpreting the findings. Firstly, the absence of a mediation model in Study 2 to explore the predictive role of need satisfaction/frustration variables on affect, which in turn mediates creative outcomes, represents a notable limitation. This omission may have limited the depth of our understanding regarding the underlying mechanisms linking these constructs.

Secondly, another limitation of our study is the reliance on established scales, such as the BPNS [47], which may not fully capture the nuances of need satisfaction and thwarting. Additionally, the availability of alternative and more recent scales, such as the Basic Psychological Need Satisfaction and Frustration Scale (BPBSFS) [60], presents an opportunity for future research to explore their applicability in similar contexts. Moving forward, researchers could consider utilizing these alternative scales to measure need satisfaction and thwarting, thereby providing a more comprehensive understanding of the constructs under investigation. Moreover, investigating the relationships between these alternative scales and other relevant variables in the context of affect and creative performance could enrich our understanding of psychological processes.

Thirdly, this study did not find a significant gender effect on creative performance in the sample from Study 2. However, it is important to acknowledge that this finding may be influenced by various social and cultural factors. As indicated by recent meta-analyses, the relationship between gender and creative performance can be contingent upon the cultural context, with communal cultures potentially mitigating gender disparities in creativity. Given this, future research could delve deeper into the role of organizational culture in shaping gender differences in creative outcomes.

Fourthly, this study utilized the Euclidean distance method for clustering analysis. It is important to acknowledge that there are various other popular clustering methods available. For instance, Chi-square or phi distance, along with non-geometric linkage methods, have been suggested for clustering count data. Additionally, there are alternative optimal clustering methods that can be employed for classifying count data, as demonstrated by Aprahamian & El-Amine [61]. Future research endeavors could explore different clustering methods to further enrich the content related to autonomy-supportive and controlling emotions. By employing alternative clustering techniques, researchers can gain deeper insights into the nuances of affective experiences and their impact on various outcomes. This approach would contribute to a more comprehensive understanding of the role of affect in different contexts and facilitate the development of more effective interventions and strategies in organizational settings.

Additionally, employing larger and more diverse samples across different cultural contexts could provide a clearer understanding of the nuanced interactions between gender, culture, and creativity. Moreover, qualitative studies exploring individuals' perceptions and experiences within specific organizational cultures may offer valuable insights into the mechanisms underlying gender disparities in creative performance. Overall, a multidimensional approach considering both individual and contextual factors is essential for elucidating the complexities of gender differences in creative outcomes. Addressing these limitations in future research could offer valuable insights into the nuanced interplay between need satisfaction/frustration, affect, and creative outcomes.

## 9. Conclusions

In summary, affect under need satisfaction comprises moderate levels of positive emotions, including excited, enthusiastic, proud, inspired, interested, attentive, determined, strong, and active. Conversely, affect under need thwarting entails slight arousal levels of emotions such as feeling upset, distressed, jittery, irritable, attentive, strong, alert, determined, active, with low levels of nervous and afraid. Our findings reveal a positive relationship between affect under need satisfaction and creative performance, while a negative relationship exists between affect under need thwarting and creative performance.

## Ethics declarations

This study was reviewed and approved by the Ethics Committee for Biomedical Research of Medical College, Hebei University of Engineering, with the approval number: No. 2023 [K] 030-20.

## Funding

This work was supported by the Fundamental Research Funds for the Central Universities of Civil Aviation University of China (3122021094).

## Data availability statement

Data will be made available on request.

## Additional information

No additional information is available for this paper.

## CRediT authorship contribution statement

**Lan Ye:** Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Hua Sun:** Project administration, Formal analysis, Conceptualization. **Jian Zhang:** Writing – review & editing, Writing – original draft, Conceptualization. **Bo Dong:** Writing – review & editing, Conceptualization. **Xiao Chu:** Writing – review & editing, Conceptualization. **Jingyi Tao:** Writing – review & editing, Writing – original draft. **Na Zhang:** Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology. **Xiumei Zheng:** Writing – review & editing, Visualization, Validation, Software. **Ran Gong:** Validation, Supervision, Software, Methodology, Investigation.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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