



## ARTICLE

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# The role of the school innovative climate in the relationship between proactive personality and creative behavior among students from Chinese normal colleges

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As China advances towards becoming an innovation-driven nation, nurturing creativity in normal college students—future educators—is crucial, as it enhances their teaching strategies and supports the cultivation of innovative talents essential for national development. This study aims to explore the relationship between cognitive flexibility and school innovation climate in the context of normal college students' proactive personality and creative behavior. A total of 1795 normal college students were assessed using the Proactive Personality Scale, Cognitive Flexibility Scale, School Innovation Climate Scale, and Creative Behavior Scale. The results of this study showed that normal college students' proactive personality positively predicted creative behavior ( $\beta = 0.526, p < 0.001$ ), and cognitive flexibility played an intermediary role in the relationship between normal college students' proactive personality and creative behavior [CI: 0.200, 0.322]. The interaction term between proactive personality and school innovation climate had a significant positive predictive effect on creative behavior ( $\beta = 0.094, p < 0.01$ ). In both high and low school innovation climate groups, proactive personality positively predicted creative behavior through cognitive flexibility. However, the high-scoring group showed a more significant impact compared to the low-scoring group. This study enriches the theory of creative personality, emphasizing the positive influence of individual traits, cognitive processes, and environmental factors on creative behavior. Furthermore, it provides a deeper understanding of the mechanism through which proactive personality influences creative behavior, offering valuable insights and guidance for future interventions in creative behavior.

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With the rapid development of human society, knowledge-based economies have been growing, signifying that knowledge and innovation capabilities will become crucial strategic resources for the economic and social development of nations or regions, as well as for gaining international competitive advantages (Kao et al., 2017; Mullet et al., 2016). China is currently at a critical stage of social transformation, and becoming an innovation-driven country is part of its next development plan (Xue, 2023). Especially in the field of higher education, universities are playing varying roles in the mission of cultivating innovative talents (Li et al., 2019). As the main actors in creative activities, college students must be nurtured in their creative abilities, as this is the core element of cultivating innovative talents and is an inevitable requirement of the times (Chen and Chen, 2010). However, it is important to note that the impact of creativity is not always significant, particularly in terms of its effect on academic ability and professional competence, where variations exist (Calafato, 2024; Gill and Prowse, 2024). Nevertheless, for normal college students, who will become future educators, their innovative abilities remain crucial for their future development. Creativity helps teachers employ innovative teaching strategies and positively influences their teaching style (Ghanizadeh and Jahedizadeh, 2016).

Creativity is the ability to generate novel and valuable ideas (Kolb, 2014; Piffer, 2012). It is a manifestation of human cognitive intelligence and has the capacity to stimulate individual knowledge growth (Poon et al., 2014). Creativity assists individuals in transforming knowledge into economic value, thereby providing sustained competitive advantages for both individuals and organizations (Wu et al., 2014). Despite the significant value of creativity as an ability, there are still some issues concerning the cultivation of creativity in college students of normal major. For example, due to the influence of traditional educational methods, Chinese university teaching models typically center on textbooks and teachers, with instructors imparting knowledge to students. This teaching model leads students to become accustomed to passively receiving theoretical knowledge, which hinders the development of active innovation and creativity (Mullen, 2017). Moreover, the limited opportunities provided in Chinese higher education for students to exercise creativity further inhibit their creative development (Xue, 2023). Furthermore, individual personality traits can also influence the development of creativity (Kandler et al., 2016).

Although creative behavior is influenced by multiple factors, individual positive qualities such as proactive personality play an undeniable role in promoting creative behavior (Pan et al., 2021). Proactive personality is typically characterized by proactiveness, perseverance, self-confidence, and a strong desire for challenges, all of which have a positive impact on the expression of creative behavior (Chae and Park, 2022). However, the formation of creative behavior is a complex process that is influenced by both individual and environmental factors. The Creative Personality Theory (Barron, 1955) emphasizes the influence of individual personality traits on creativity. However, this theory does not emphasize the impact of external environmental factors on creativity. Therefore, this study introduces two key variables, cognitive flexibility, and the school innovative climate, to analyze the influence of individual and environmental factors on the creative behavior of Chinese college students, thus enriching the existing theoretical framework.

### Proactive personality and creative behavior

Proactive personality refers to a stable tendency in individuals to take actions to influence and change their surrounding environment (Bateman and Crant, 1993). Proactive personality has three

key characteristics: proactivity, a change-oriented orientation, and a focus on the future (Griffin et al., 2010; Parker and Collins, 2010). Proactivity means that individuals with proactive personalities are rarely constrained by their environment; they are committed to manipulating their surroundings. A change-oriented orientation implies that individuals with proactive personalities have a heightened sensitivity to identify favorable opportunities and take proactive actions until meaningful changes are achieved. Focusing on the future means that individuals with proactive personalities serve as leaders in conveying organizational missions, identifying and resolving problems, and taking actions to influence and change the world around them. College students with a proactive personality often have a long-term vision, are able to seize opportunities, face challenges courageously, and achieve better academic performance (Sheng and Caiga, 2024; Zhu et al., 2017). Therefore, proactive personality can be considered an internal driving force that motivates students to engage actively and persistently in learning behaviors.

Numerous studies have demonstrated that proactive personality is a significant predictor of creative behavior (Pan et al., 2021; Zhang et al., 2014). Individuals with proactive personalities are change-oriented, meaning they tend to alter their environments to better suit their needs (Parker et al., 2019). In the process of changing their environments, proactive individuals often seek new and more effective ways of doing things (Choi and Thompson, 2005) and persevere in their efforts until their goals are achieved. Therefore, a proactive personality is often associated with beneficial outcomes, including higher levels of achievement and creativity (Parker et al., 2019; Yang and Chau, 2016). Additionally, individuals with proactive personalities tend to build energy, inspiration, and motivation, which enable them to be more engaged and creative in their work (Karimi et al., 2022; Zhang et al., 2021). Furthermore, according to Smith (2008), the creative personality is not simply a collection of traits but a dynamic process. Individuals with a proactive personality usually possess greater innovative potential because they are more inclined to seek and create opportunities to demonstrate their creativity. This internal drive aligns with Smith's process-oriented theory, which posits that the creative personality is expressed in an ongoing dynamic process rather than as a fixed set of traits.

In summary, based on the above information, we propose the following hypothesis:

H1: Proactive personality is significantly positively correlated with creative behavior.

### The mediating role of cognitive flexibility

Cognitive flexibility refers to the ability to change psychological or behavioral responses based on situational demands, adapting to new changes (Kashdan and Rottenberg, 2010). It holds significant value in helping individuals solve problems, adapt to their environment, and generate innovative ideas (Barbey et al., 2013). This reflects an individual's capacity to apply and transfer knowledge and skills in different situations and domains. Cognitive flexibility enhances personal positive traits. For instance, as a predictor of college students' subjective vitality, cognitive flexibility helps students maintain high levels of energy and positivity when faced with challenging tasks, enabling them to effectively address challenges and pressures to achieve specific goals (Algharaibeh, 2020). Moreover, such students can switch thinking patterns and remain undisturbed by negative emotions when facing challenging situations (Toraman et al., 2020).

Murdock et al. (2013) pointed out that personality traits may influence cognitive flexibility. Individuals with proactive personalities tend to recognize favorable opportunities, proactively change their environment, and act as pioneers in identifying and

solving problems (Fuller and Marler, 2009). Moreover, individuals with proactive personalities are more inclined to make diversified choices compared to others (Grant and Ashford, 2008). The traits of proactive personality are essential conditions for fostering flexibility. Based on this, it can be hypothesized that proactive personality predicts an individual's cognitive flexibility.

Cognitive flexibility is considered an important prerequisite for generating creativity (Diamond, 2013). According to the Dual Pathway to Creativity model (De Dreu et al., 2008), the output of creativity, such as creative ideas, problem-solving solutions, and insights, can be achieved through both the flexibility pathway and the persistence pathway. Dreux et al. (2011) also suggest that cognitive flexibility is an ability to adapt one's thoughts and behaviors, which can stimulate creative behavior during cognitive disruption, cognitive restructuring, and the association with different things. Kiss et al. (2020) additionally point out that individuals with higher cognitive flexibility tend to think divergently, conceive solutions to problems from different perspectives, and proactively seek resources to implement their innovative ideas. Based on this, it can be hypothesized that cognitive flexibility has a positive predictive effect on creative behavior. Moreover, when investigating the relationship between cognitive flexibility and creative behavior, cognitive flexibility often acts as a mediator (Lin et al., 2014; Wang and Chang, 2022; Zuo et al., 2019). Based on the above analysis, this study proposes the following hypotheses:

H2: Cognitive flexibility mediates the relationship between proactive personality and creative behavior.

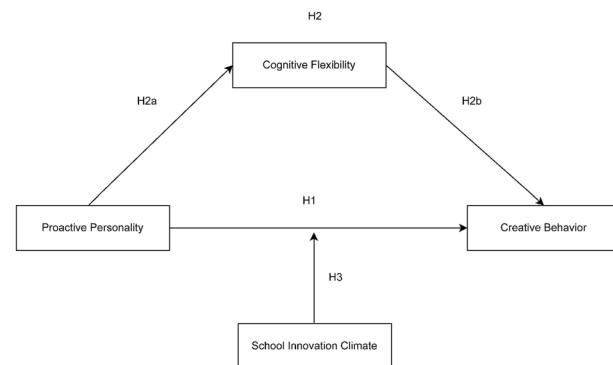
H2a: Proactive personality is significantly positively correlated with cognitive flexibility.

H2b: Cognitive flexibility is significantly positively correlated with creative behavior.

### The moderating role of school innovative climate

For an organization to foster innovation, it is crucial to create an innovative climate that promotes employee motivation and behavior (Hu, 2023). Amabile et al. (1996) define an innovative climate as an individual's perceptual description of the environment, reflecting the perceived level of innovation capability and support for innovation within the work environment. Generally, a positive innovative climate within an organization is conducive to stimulating employees' innovative behavior, while a negative one can hinder such behavior (Xie et al., 2018). Hu (2023) suggest that in an organizational environment supportive of innovation, individuals feel that the organization values innovative activities, which enhances their confidence and motivation for innovation. Furthermore, Kang et al. (2016) found that a school innovative climate can stimulate students' creative behaviors, thereby enhancing their behavioral engagement, academic self-efficacy, interest in innovation, and perceived utility of innovation.

Trait Activation Theory posits that individual behavior is the result of the interplay between external situations (such as organizational support and organizational culture) and personal traits (such as personality and abilities) (Tett and Guterman, 2000). This theory explains how the size and direction of the relationship between personal traits and behavior can vary depending on the context (Tett and Burnett, 2003). Therefore, in the study of the relationship between proactive personality and creative behavior, it is necessary to integrate both individual trait factors and contextual factors to jointly examine their mechanisms. Previous research has indicated that the influence of proactive personality on creative behavior can be "enhanced" or "diminished" by organizational contextual factors (Du et al., 2021). For example, Yuan et al. (2022) pointed out that an innovative climate provides students with an environment that supports and stimulates creativity, making them more susceptible



**Fig. 1 The theoretical hypothetical model of this study.** Theoretical hypothetical model.

**Table 1 Social demographic features of participants (N = 1795).**

Variables	Frequencies	Percentages
Gender		
Female	1530	85.24%
Male	265	14.76%
Age		
17-19 years old	820	45.68%
20-22 years old	864	48.13%
23-25 years old	97	5.40%
26-28 years old	14	0.78%
Educational Level		
Associate's Degree	510	28.41%
Bachelor's Degree	1187	66.13%
Graduate Degree	98	5.46%

to environmental influences, thereby encouraging more active participation in creative activities and further promoting the development of creative behavior.

Based on the above analysis, this study proposes the following hypothesis:

H3: The school innovative climate moderates the relationship between proactive personality and creative behavior.

The theoretical hypothetical model of this study is shown in Fig. 1.

### Methods

**Participants.** The present study utilized a random sampling method to select normal universities in six different provinces: Shandong, Guangdong, Hunan, Heilongjiang, Jiangxi, and Yunnan. We distributed survey questionnaires using an online survey platform. Ultimately, 2421 questionnaires were collected. After eliminating questionnaires with noticeable time deficiencies and inaccuracies, a total of 1795 valid questionnaires were obtained, resulting in an effective response rate of 74.14%. The Research Ethics Review Committee of XXX conducted an ethical review and granted approval for this study, following the guidelines outlined in the Helsinki Declaration. Demographic variables of the participants are presented in Table 1.

### Measure

**Proactive Personality Scale.** Bateman and Crant (1993) developed the Proactive Personality Scale, which was used in this study. The scale consists of 17 items, with one example item being: "When I see something I don't like, I will try to change it." Among these items, 14 are reverse-scored. The scale uses a 5-point Likert scoring system, with 1 representing "strongly disagree" and 5 representing "strongly agree." The Cronbach's alpha coefficient of this scale were 0.913.

**Table 2 Means, standard deviations, and correlations of the major study variables.**

Variables	M	SD	1	2	3	4	5	6	7
1. Gender	0.150	0.355	1						
2. Age	19.900	1.498	0.044	1					
3. Educational Level	1.770	0.535	0.102**	0.417**	1				
4. Proactive Personality	3.611	0.480	0.009	0.032	-0.029	1			
5. Cognitive Flexibility	4.109	0.683	0.071**	0.002	-0.005	0.680**	1		
6. School Innovation Climate	4.015	0.565	-0.076**	0.058*	-0.039	0.570**	0.413**	1	
7. Creative Behavior	3.125	0.677	0.084**	0.018	0.055*	0.578**	0.547**	0.345**	1

\*\* $p < 0.01$ , \* $p < 0.05$ .

**Cognitive Flexibility Scale.** This study utilizes the Cognitive Flexibility Scale developed by Martin and Rubin (1995) to assess an individual's cognitive adaptability and flexibility. The revised scale now contains 13 items, such as "I can communicate an idea in a variety of different ways." The scale employs a 6-point Likert scoring system, with 1 indicating "strongly disagree" and 6 indicating "strongly agree." The Cronbach's alpha coefficient of this scale were 0.906.

**School Innovation Climate Scale.** For the measurement of the school's innovation climate, this study uses the School Innovation climate Scale developed by (Zhengang et al., 2016) and consists of 12 items. It is divided into three dimensions, including peer support, teacher support, and school support. An example item is: "When I have a new idea, my classmates actively offer suggestions and opinions." The scale employs a 5-point Likert scoring system, with 1 representing "strongly disagree" and 5 representing "strongly agree." The Cronbach's alpha coefficient of this scale were 0.964.

**Creative Behavior Scale.** This study utilizes the Creative Behavior Scale developed by Runco et al. (2001). The scale comprises 23 items and has two dimensions. An example item is: "I often feel excited about my new ideas." The scale uses a 5-point Likert scoring system, with 1 indicating "never" and 5 indicating "always." The Cronbach's alpha coefficient of this scale were 0.952.

**Data analysis method.** The data analysis section of this study utilized SPSS 22.0 and Process plugin 4.0. This study employed a combination of statistical analysis methods. First, the Harman single-factor test was used to ensure that the data were not affected by common method bias. Then, descriptive statistical analysis was conducted to calculate the mean, standard deviation, and correlations between variables. Subsequently, a moderated mediation analysis was performed using Model 5 from the SPSS Process plugin, with 5000 bootstrap resamples to assess the indirect effect of proactive personality on creative behavior and to test the moderating role of school innovation climate. To further understand the moderation effect, simple slope analysis and the Johnson-Neyman method were employed, providing deeper insights into how the strength of the impact of proactive personality on creative behavior through cognitive flexibility varies at different levels of school innovation climate. Based on previous literature, the respondents' gender, age, and education level (Brandau et al., 2007) were used as control variables in this study.

## Results

**Testing for common method bias.** Using the Harman single-factor test method, the results of the test show that there are 8 factor eigenvalues greater than 1. The proportion of variance explained by the first factor is 36.060%, which is less than the critical value of 40% (Podsakoff et al., 2003). Therefore, there is no apparent common method bias in the measurement data of this study.

**Descriptive statistical analysis.** Averages and standard deviations of the four variables, namely creative behavior, cognitive flexibility, proactive personality, and school innovation climate, are analyzed, as well as the correlations between these variables, as shown in Table 2.

Creative behavior is significantly positively correlated with proactive personality ( $r = 0.578$ ,  $p < 0.01$ ), with cognitive flexibility ( $r = 0.547$ ,  $p < 0.01$ ), and with school innovation climate ( $r = 0.345$ ,  $p < 0.01$ ). Cognitive flexibility is significantly positively correlated with proactive personality ( $r = 0.680$ ,  $p < 0.01$ ) and with school innovation climate ( $r = 0.413$ ,  $p < 0.01$ ). Proactive personality is significantly positively correlated with school innovation climate ( $r = 0.570$ ,  $p < 0.01$ ).

**Moderated mediation analysis.** In this study, all variables were standardized, and data analysis was conducted using Model 5 from the Process plugin program in SPSS (Hayes, 2013). Parameter estimates were obtained through bootstrap resampling with a sample size of 5000. Significance of each parameter was determined based on a 95% confidence interval. Controlling for gender, age, and education, proactive personality was the independent variable, creative behavior was the dependent variable, cognitive flexibility served as the mediator, and school innovation climate acted as the moderator. The analysis aimed to test the mediating effect of cognitive flexibility and the moderating effect of school innovation climate on the relationship between proactive personality and creative behavior.

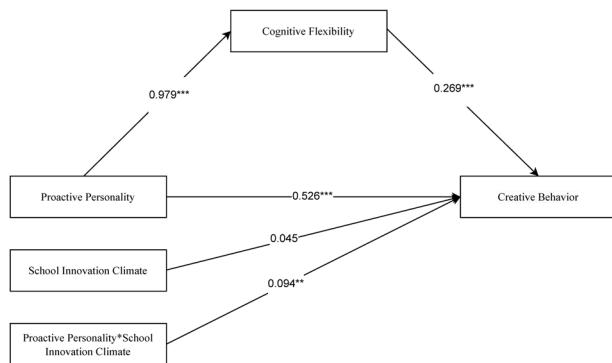
The results of the analysis revealed that the 95% confidence interval for the indirect effect was [0.200, 0.322], and it did not include 0, indicating a significant mediating effect. The mediating effect of cognitive flexibility was 0.261. The interaction term between proactive personality and school innovation climate had a significant positive predictive effect on creative behavior ( $\beta = 0.094$ ,  $p < 0.01$ ). This indicates that the moderating effect of school innovation climate in this model is significant, as shown in Table 3 and Fig. 2.

To further analyze the nature of school innovation climate as a moderating variable in this model, this study conducted a simple slope analysis on the data. The moderating variable, school innovation climate, was considered in two conditions: one with a one-standard-deviation increase (high school innovation climate group) and the other with a one-standard-deviation decrease (low school innovation climate group). In the high school innovation climate group, proactive personality exhibited a significant positive predictive effect on creative behavior through cognitive flexibility (simple slope = 0.579,  $p < 0.001$ ). Similarly, in the low school innovation climate group, proactive personality showed a significant positive predictive effect on creative behavior through cognitive flexibility (simple slope = 0.473,  $p < 0.001$ ), as depicted in Table 4 and Fig. 3.

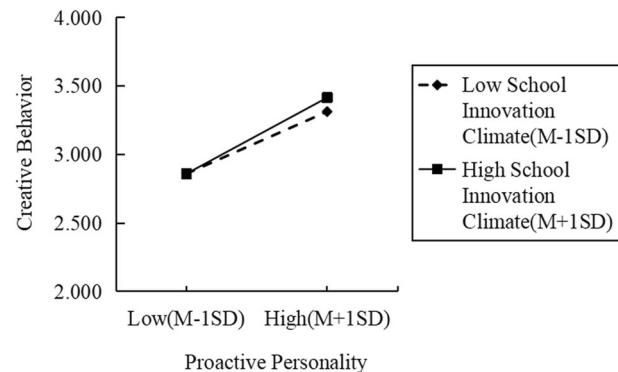
**Table 3 Results of mediation with moderation analysis.**

Variables/Paths	Model 1 Dependent Variable: Cognitive Flexibility				Model 2 Dependent Variable: Creative Behavior			
	$\beta$	t	Boot LLCI	Boot ULCI	$\beta$	t	Boot LLCI	Boot ULCI
Proactive Personality	0.979	39.439***	0.921	1.018	0.526	13.303***	0.448	0.604
Cognitive Flexibility			0.269	10.696***	0.220	0.319		
School Innovation Climate			0.045	1.629	-0.009	0.099		
Proactive Personality*School Innovation Climate			0.094	3.129**	0.035	0.153		
Proactive Personality → Cognitive Flexibility → Creative Behavior			0.261		0.200	0.322		
Gender	0.124	3.709***	0.058	0.189	0.103	2.878**	0.033	0.173
Age	-0.014	-1.632	-0.031	0.003	-0.014	-1.469	-0.032	0.005
Education	0.026	1.079	-0.021	0.074	0.091	3.518***	0.040	0.142
R <sup>2</sup>	0.468				0.390			
F		393.315***				163.058***		

\*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ .



**Fig. 2 The model path diagram of this study.** Note: \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ .

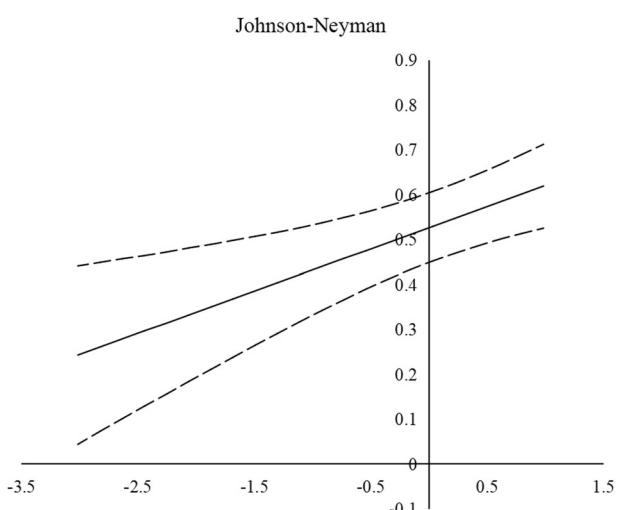


**Fig. 3 The simple slope plot of this study.** Simple slope plot.

Table 4 Mediation effects at different levels of school innovation climate.					
Indicator	Effect size	S.E.	t	Bootstrap 95% CI	
				Boot LL	Boot UL
M-1SD	0.473	0.044	10.738***	0.387	0.559
M	0.526	0.040	13.303***	0.448	0.604
M + 1SD	0.579	0.042	13.799***	0.497	0.661

\*\*\*  $p < 0.001$ .

To more precisely estimate the range of the effect of school innovation climate, this study employed the Johnson-Neyman method to calculate the significant intervals for the simple slope of the impact of proactive personality through cognitive flexibility on creative behavior at different values of school innovation climate. The simple slope graph is presented in Fig. 4. In the graph, the horizontal axis represents the standard scores of school innovation climate, and the vertical axis represents the simple slope of proactive personality. The upper line represents the upper limit of the 95% confidence interval, the middle line represents the estimated simple slope of proactive personality through cognitive flexibility on creative behavior, and the lower line represents the lower limit of the 95% confidence interval. The results show that when school innovation climate takes any value, proactive personality's effect on creative behavior through cognitive flexibility is



**Fig. 4 The J-N diagram of this study.** J-N diagram.

significant and positively predictive. Furthermore, as the level of school innovation climate increases, the effect of proactive personality through cognitive flexibility on creative behavior becomes more pronounced.

## Discussion

Based on research results, we have found that the proactive personality of normal college students can significantly positively

influence creative behavior. This result aligns with our research hypothesis and is consistent with the conclusions of many researchers (Jiang, 2017; Li et al., 2017; Liu et al., 2017). A proactive personality is an important factor in enhancing individual creativity within an organization (Karimi et al., 2022; Kim et al., 2010). This is because proactive individuals often exhibit strong proactiveness, a pursuit of change, and exceptional foresight. These personal traits play a crucial role in shaping the development of individual creative thinking and actions (Bindl and Parker, 2011; Kim et al., 2010; Seibert et al., 2001). It can be said that creativity is a result of unique individual characteristics (Chang et al., 2014). Therefore, individuals with a proactive personality are more likely to demonstrate their creative behavior.

The results of this study show that cognitive flexibility mediates the relationship between normal college students' proactive personality and creative behavior. In other words, a proactive personality can influence normal college students' creative behavior through cognitive flexibility. Individuals with a proactive personality typically possess traits of flexibility and diverse thinking, enabling them to identify and evaluate opportunities and actively change their environment (Kim et al., 2010). Furthermore, individuals with a proactive personality are committed to self-improvement and development, actively learning new knowledge and skills (Matsuo, 2019). As a result, they are more likely to break through existing cognitive barriers and thought patterns, adopting more flexible cognitive models for problem-solving and thinking. Therefore, a proactive personality positively promotes individual cognitive flexibility. Higher cognitive flexibility frees individuals from the constraints of existing thought patterns, knowledge reserves, and experiences (Zuo et al., 2019). Under its influence, people become more attentive to novel stimuli, free from the constraints of existing knowledge and thought patterns, and consequently display higher levels of creativity. Thus, normal college students with proactive personalities actively acquire new knowledge and skills, and their flexible thinking and cognitive models give them a higher level of environmental insight. Such normal college students can maintain their innovative vitality and inspire creative behavior.

The examination results of this study reveal that the school's innovation climate plays a moderating role in the direct path between proactive personality and creative behavior. Through simple slope analysis, it was found that in both the high-school innovation climate group and the low-school innovation climate group, proactive personality has a significant positive predictive effect on creative behavior. According to the principles of Self-Determination Theory, a supportive environment can regulate and internalize students' motivation by satisfying their intrinsic psychological needs, ultimately leading to positive learning outcomes (Deci and Ryan, 2000). In higher education, a rich innovation climate in schools helps fulfill students' basic psychological needs, encouraging them to actively engage in innovative activities, thereby better promoting the development of students' creative behavior.

This study also identified a moderated mediation effect. The results show that in both the high-school innovation climate group and the low-school innovation climate group, proactive personality has a significant positive predictive effect on creative behavior through cognitive flexibility. However, the high-score group exhibits a more significant impact compared to the low-score group. Schools with a higher innovation climate typically provide more support and encouragement for students to develop creative thinking and behavior. These schools may offer richer resources such as innovative courses to stimulate students' creative potential. Therefore, in this encouraging innovation climate, students are more proactive, and their thinking becomes more flexible, ultimately leading to enhanced creative behavior. In

contrast, schools with a low innovation climate may lack these resources and opportunities, thereby limiting students' creative performance.

This study holds significant importance in enriching existing theories related to creativity, particularly Creative Personality Theory as proposed by Barron (1955). Barron's theory emphasizes the influence of individual personality traits such as open-mindedness, autonomy, and adventurousness on creativity. However, the theory does not sufficiently consider the impact of external environmental factors on creativity. Through empirical research methods, this study analyzes the interaction between individual and environmental factors to reveal how these factors jointly shape creative behavior. In this study, we found that individuals with proactive personalities and traits of cognitive flexibility play important roles in fostering creativity. This suggests that individuals with higher levels of curiosity, adventurousness, and autonomy are more likely to exhibit creative behavior. Importantly, the school's innovation climate has also been shown to have a positive impact on the creativity of normal college students. This implies that characteristics of the school environment that encourage innovation, provide creative opportunities, and support creative expression can stimulate and nurture creative thinking and behavior. In summary, the results of this study not only enrich the theoretical foundation of Creative Personality Theory but also provide empirical support for creativity research, emphasizing the complex interaction between individual traits, cognitive processes, and environmental factors. These findings offer valuable references and guidance for future creativity research and practice.

This study also has practical implications for enhancing the creative behavior of normal college students. Firstly, efforts should be made to cultivate proactive qualities in normal college students. Encourage students to set specific and challenging academic and career goals and help them formulate practical plans to achieve these goals. Provide students with opportunities to autonomously choose courses, research projects, and hobbies to encourage their active engagement in learning and exploration. Schools can also recognize and reward students' innovative projects by establishing scholarships, awards, or honors.

Secondly, there is a need to strengthen the cultivation of cognitive flexibility in normal college students. Schools can offer interdisciplinary courses that provide students with opportunities for interdisciplinary learning, encouraging them to integrate knowledge and thinking from different fields to promote innovation. Provide students with training in creative problem-solving, teaching them various methods and techniques for problem-solving. Encourage students to try new thinking patterns and approaches, continuously challenging and expanding their cognitive boundaries. Lastly, provide targeted feedback and guidance to help students improve their creative thinking and problem-solving skills.

Finally, schools should create an climate that encourages innovation. Support and promote innovative courses, research projects, and entrepreneurial activities in schools to stimulate students' innovative spirit. Create a social environment that encourages students to share knowledge, collaborate, and innovate, such as maker spaces. Provide students with resource support, including laboratories, libraries, and technological facilities, to support their innovative projects and research. School leadership can advocate and support a culture of innovation, ensuring that innovation and creative thinking are valued and rewarded.

**Limitations and prospects.** Firstly, this study employed a cross-sectional research design, analyzing relationships between variables through one-time data collection. This design limits our

understanding of causality. Future research could employ longitudinal research designs to track changes in individuals over time to explore the causal relationships between these variables.

Secondly, this study used a single self-report scale to measure proactive personality, cognitive flexibility, school innovation climate, and creative behavior. Although these scales are widely used in psychological research and have reliability and validity, they still rely on self-reported data and may be subject to self-report biases. Future research could consider using multiple data sources, such as observations, peer evaluations, or objective measurement tools, to collect more comprehensive data.

Lastly, this study involved complex mechanisms, including the mediating role of cognitive flexibility between proactive personality and creative behavior, and the moderating effect of the school's innovation climate on these relationships. Although we attempted to control some variables in the study, there may still be other unconsidered factors that could influence our results. Future research can further explore these influencing mechanisms, including a more detailed examination of other mediating or moderating factors, to enrich empirical research on normal college students' creative behavior.

## Conclusion

The results of this study show a positive correlation between normal college students' proactive personality and creative behavior. Proactive personality in normal college students can influence creative behavior through cognitive flexibility. The school's innovation climate plays a moderating role between proactive personality and creative behavior. This study enriches the theoretical foundation of Creative Personality Theory, emphasizing the positive influence of individual traits, cognitive processes, and environmental factors on creative behavior. Furthermore, it provides an in-depth explanation of the mechanisms through which proactive personality influences creative behavior, offering valuable insights and guidance for future interventions aimed at enhancing creative behavior.

## Data availability

Dataset available via OSF: <https://osf.io/58u9v/>. The original data of the main variables of this study are shared in this data.

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## Author contributions

The execution of this paper was a collaborative effort on behalf of all author. YC conceptualized, designed the study, conducted the data collection and analysis, drafted and revised the manuscript.

## Competing interests

The author declares no competing interests.

## Ethics approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the Helsinki Declaration. This study was approved by the Research Ethics Committee of the Qilu Normal University (No.202308006).

## Consent for publication

Consent for publication was obtained from all individual participants included in the study.

## Informed consent

Before the study began, all participants were provided with their informed consent, confirming their voluntary involvement and understanding of the study's aims, goals, and how their data would be used. They received comprehensive details about the study's nature and objectives, and their agreement to participate was given freely, without any pressure or improper influence.

## Additional information

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