



## OPEN ACCESS

## EDITED BY

Sujita Kumar Kar,  
King George's Medical University, India

## REVIEWED BY

Vidya Kl,  
King George's Medical University, India  
Anil Kakunje,  
Yenepoya Medical College, India

## \*CORRESPONDENCE

Guang Yang  
✉ yangguangedu@foxmail.com

## SPECIALTY SECTION

This article was submitted to  
Public Mental Health,  
a section of the journal  
Frontiers in Psychiatry

RECEIVED 11 October 2022

ACCEPTED 05 December 2022

PUBLISHED 22 December 2022

## CITATION

Xu Y, Yang G, Yan C, Li J and Zhang J  
(2022) Predictive effect of resilience  
on self-efficacy during the COVID-19  
pandemic: The moderating role  
of creativity.  
*Front. Psychiatry* 13:1066759.  
doi: 10.3389/fpsy.2022.1066759

## COPYRIGHT

© 2022 Xu, Yang, Yan, Li and Zhang.  
This is an open-access article  
distributed under the terms of the  
[Creative Commons Attribution License  
\(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or  
reproduction in other forums is  
permitted, provided the original  
author(s) and the copyright owner(s)  
are credited and that the original  
publication in this journal is cited, in  
accordance with accepted academic  
practice. No use, distribution or  
reproduction is permitted which does  
not comply with these terms.

# Predictive effect of resilience on self-efficacy during the COVID-19 pandemic: The moderating role of creativity

Yanhua Xu<sup>1</sup>, Guang Yang<sup>2\*</sup>, Chongshan Yan<sup>2</sup>, Jiatong Li<sup>2</sup> and Jingwei Zhang<sup>1</sup>

<sup>1</sup>School of Geography and Environment, Jiangxi Normal University, Nanchang, China, <sup>2</sup>College of Teacher Education, Capital Normal University, Beijing, China

**Introduction:** To appraise the relationship and mechanism between resilience and self-efficacy in the context of the COVID-19 pandemic, we proposed a model to investigate the effect of resilience on self-efficacy and the moderating effect of creativity in this regard.

**Methods:** Scales that measured resilience, creative behavior, and self-efficacy were rated by 881 college students in China to establish the moderating model.

**Results:** The results showed that resilience and self-efficacy of participating college students were positively correlated, which meant that high resilience could predict a high level of self-efficacy. Moderating analysis using the SPSS PROCESS plug-in showed that creativity was an important element of resilience that positively affected self-efficacy and that this moderating effect was more significant in participants with a high degree of creativity.

**Discussion:** These findings can provide a better understanding of the relationship between resilience and self-efficacy in demonstrating the traumatic impact of the COVID-19 pandemic on adolescent mental health and academic performance.

## KEYWORDS

resilience, self-efficacy, creativity, college students, COVID-19

## 1 Introduction

A recent threat to the health of people worldwide is the ongoing outbreak of the respiratory disease known as COVID-19 (1). To date, the world has paid a huge price during this pandemic in terms of the loss of human life and economic impact (2). To contain the epidemic, many countries have imposed social distancing and declared lockdowns to regulate movement control (3). In such circumstances, many people are obliged to use the social media among the limited means of communication. Thus, national television channels or social media platforms have been adopted for education (4). One damaging aspect of social media use lies in its potential to spread false, alarmist,

and exaggerated information that can create fear, stress, depression, and anxiety in people with and without underlying mental illness (5). In the case of the COVID-19 pandemic, college students may experience varying degrees of fear, stress, depression, and other emotions because their learning is restricted to a few social and online channels; this can profoundly affect their mental health and academic performance (6). Accordingly, we started with examining psychological resilience to evaluate whether it was related to college students' self-efficacy under the epidemic environment, and how creativity and active thinking might play a regulating role in this respect.

The global epidemic of the coronavirus disease presents a major threat to public health worldwide (7). There have been considerable differences in the way people cope with this crisis. The capacity to withstand setbacks, adapt positively, and recover from adversity is collectively known as *resilience* (8). Resilience is essential for coping effectively with difficulties, uncertainties, and changes (9), and it can be applied in settings related to prevention (pre-exposure to stress) or treatment (recovery from the adverse effects of such anxiety) (10). Past research has shown that resilience can counteract the negative effects of poor health (11) and reduce mortality by 6% (12), as well as moderate depression (13) and negative emotions (14). However, few studies have used resilience as an influencing variable to examine its mechanism of action in college-student populations during the COVID-19 pandemic. Here, we delve into how resilience has affected other psychological factors among college students during the pandemic. At the same time, given the challenges posed by the disease outbreak, the role of creativity cannot be underestimated. Beghetto and Kaufman propose the 4C model, which can be used to analyze creativity in that context (15). The category of *MINI-C* describes exploratory behaviors that are not necessarily considered novel when viewed in the larger historical perspective, but that have personal meaning to the individual creator. *LITTLE-C*, or everyday creativities, encompasses the ordinary creative behaviors of most persons. *PRO-C* is reserved for those who have reached or are approaching an expert level of creativity, even if they may not have achieved excellence. The medical staff on the front line who attend to the pandemic patients and the technical experts who develop platforms for online education to protect students show evidence of *PRO-C*. Those categorized under *BIG-C* are often considered geniuses in their field and represent the pinnacle of what is possible (16). During the COVID-19 pandemic, people have tended to develop new forms of amusement and entertainment because of isolation or the reduction of in-person entertainment. Such behavior can be seen as the concentrated expression of *MINI-C* and *LITTLE-C*. On January 11, 2020, the genetic sequence of the COVID-2 coronavirus, was released, triggering intensive scientific activities to develop a vaccine for this disease (17). Therapies targeting the immunopathology of infection then became a major focus, in addition to approaches that targeted

the virus directly or block its infection (18). These activities require *BIG-C*. Creativity, as a means of coping with the uncertainty caused by the pandemic and meeting personal needs in this environment can enable people to find meaning in the mundane (19). However, there is not too much research on the mechanism of creativity as a variable that moderates psychological and behavioral change among college students. Therefore, we decided to look into how creativity might moderate the relationship between behavioral variables among students at the beginning stages of the COVID-19 pandemic.

In the relationship between creativity and self-efficacy, the latter is sometimes conceptualized as a component of resilience and post-traumatic growth (20–22), which suggests the importance of resilience for self-efficacy. Other factors that are also related to self-efficacy include autonomy (23), multiple health behaviors (24), multiple chronic diseases (25), various parenting styles (26), and adolescent adaptation to traumatic experiences (27). Nevertheless, few studies have focused on the complex relationship between resilience and self-efficacy, between resilience and creativity, or the possible inter-relationships of resilience, self-efficacy, and creativity.

## 2 Theoretical background

### 2.1 Psychological resilience

A starting point for studying the concept of resilience is with the recognition that a certain proportion of young people today are not overwhelmed when faced with serious trials and difficulties (28). Resilience has been defined as the interaction of psychological traits in the context of stressful processes (29) to shield the individual from negative effects (30). In previous studies of resilience, a number of protective factors have been identified, viz. tolerance (31), positive emotions (32), extroversion (33), self-efficacy (34), spirituality (35), self-esteem (36), and positive influence (37). These findings also support Rutter's view that resilience is an interactive concept involving a combination of serious risk experiences that nonetheless end with relatively positive psychological outcomes (38).

The definition of psychological resilience is still being discussed in the academic community. For example, it has been defined as a class of phenomena characterized by good outcomes in the face of serious threats to adaptation or development [(39), p. 228]. In other words, it reflects personal qualities that facilitate one to thrive in the face of adversity [(40), p. 76], while encompassing a complex repertoire of behavioral tendencies [(41), p. 197]. An individual's degree of success in demonstrating resilience in confronting major challenges can be conceptualized as an interplay of factors panning out in a manner that is either beneficial or detrimental to his or her wellbeing (42, 43). Traits of young people who exhibit resilience have included a "relaxed temperament" [(44), p. 185], optimism (45, 46),

personal determination and perseverance (46–48), as well as family cohesion (49).

Several theoretical models of resilience exist. For example, in a study of resilience in old age, an overarching construct of resilience has been postulated that explains the function of several psychological resources (self-esteem, and personal competence and control) (50). A three-part model of resilience (encompassing environment, physical behavior, and cognition) was used to demonstrate that social support, adaptive health practices, adaptive coping, and optimism were important in helping police officers face adversity (51). Hence, a preliminary cognitive model of resilience can potentially facilitate the application of cognitive approaches to the study of resilience in adversity (52).

## 2.2 Self-efficacy

According to the theory of social cognition and self-efficacy, one's beliefs about one's abilities and the results of one's efforts can have a powerful influence on one's behavior (53, 54). The core of the self-efficacy theory is that the initiation and persistence of behaviors and actions are primarily determined by judgments and expectations about behavioral skills and abilities and the likelihood of successful coping with environmental demands and challenges (55). Self-efficacy has received much attention in educational research. For example, it was shown that perceived self-efficacy for learning was correlated positively with students' ability in arithmetic. Generally, students with high self-efficacy are given the opportunity to be engaged in different types of tasks (56). Those who are confident in their academic abilities are more effective at monitoring their own work, solve problems more efficiently, and exhibit greater persistence than their peers who are equally able but have lower self-efficacy (57). They also work harder, assess their progress more frequently, and engage themselves in more self-regulatory strategies to succeed further (58). One's beliefs about his or her self-efficacy can be influenced by emotional and physiological states, such as anxiety, stress, fatigue, and mood; for example, high levels of anxiety undermine self-efficacy (59).

Currently, when studying self-efficacy, most researchers use an adapted version of the self-efficacy scale developed by Lent et al. (60), which was originally designed to assess the sources of mathematical self-efficacy in college students. It has since been adapted for use in academic and social settings (61–64). Matsui et al. also de-signed a scale to measure the sources of mathematical self-efficacy in college students (65), and this scale has also been used with middle school students (66). In addition, Hampton developed the Source of Academic Self-Efficacy Scale, which was subsequently validated and applied to students with learning disabilities (67).

A previous study showed that, empirically speaking, resilience was closely related to self-efficacy (68). Another study

also found that resilience was moderately to highly associated with components of self-efficacy (69). Given these findings, it is likely that resilience and self-efficacy are positively correlated, which leads to the following hypothesis:

**Hypothesis 1:** *Psychological resilience is a positive predictor of self-efficacy.*

## 2.3 Creativity

Research in creativity had its roots in the mid-twentieth century when differences in creativity between disciplines began to be studied in the 1930s (70–72). Since the term creativity was put forward, people have discussed its connotation and theory; the basis of creativity has been constantly enriched and expanded (73, 74). Guilford views creativity, in its narrow sense, as an individual's ability to perform creative acts to a noteworthy extent (75). Stein argues that it is necessary to distinguish between the internal and external frames of reference of creativity (76). Creativity is seen as the ability to produce work that is both novel (that is, original and unexpected) and appropriate (that is, useful and adapted to specific tasks) (77–81). Collins postulates that motivation stemming from personal engagement is essential to a high level of creativity in any field (82). At the individual level, creativity is closely related to personal life; for example, creativity is used when one tries to solve a difficult problem at work or in daily life (83). An analysis of the content of the *Journal of Creative Behavior* shows creativity enhancement and education to be the most common themes (84).

In addition to the 4Cs model, previous studies offer the following theories and models of creativity. The first is the 4Ps model which integrates people, process, products, and the environment (19). The second is the componential model of creativity that encompasses cognitive, personal, motivational, and social factors, including domain-related skills, creativity-related skills and task motivation (85). The model was subsequently modified by the addition of a social context component (86). The third is the creativity-investment theory, which posits that intelligence, knowledge, way of thinking, personal traits, motivation, and environment all affect creativity; here, creativity is seen as the comprehensive effects of individual psychological mechanisms and environmental factors (80).

All of the above theories align broadly with the focus of this study, namely the relationship between resilience and creativity in college students. As mentioned earlier, resilience is a positive attribute that determines the individual's response to stress and adversity. In reviewing the literature, we found that stress and creativity have been explored extensively. For example, artists and other creative professionals may find it difficult to first establish and then to maintain themselves continually in creative

work (87–89). In the current post-Fordist conditions, creative abilities are constantly challenged (90, 91). Stability, the opposite of innovation, has been much maligned by business writers and consultants despite its distinct benefits for individuals and society (92). However, stress, time constraints, and social pressure related to their work can be powerful levers that enhance the effectiveness of creative problem-solving methods (93). In addition, several studies on the relationship between perception (or emotion) and creativity (94–96) have found that positive emotions are sometimes positively associated with creativity (97, 98). Given that resilience is a positive emotion and attitude generated in the face of hardship and stress, these studies contribute to the understanding of the relationships between resilience and creativity, as well as among hardship, stress, and creativity. So, we hypothesized that:

**Hypothesis 2:** *Psychological resilience has a positive predictive effect on creativity.*

Several articles in recent literature examine the connection between creativity and self-efficacy. As with other forms of behavior, creative expressions can be influenced by one's self-judgments about his or her ability to produce novel and useful results. Such self-judgments, also called creative self-efficacy (98), are an important extension of the general concept of self-efficacy (99). Proximity to a mastery level of performance, belief in their ability to innovate, and teacher feedback have been positively correlated with the creative self-efficacy of students (100). Investigating this attribute in students may help support educators' and researchers' long-standing efforts to enhance creativity (54, 101–103). Self-efficacy provides the motivation to initiate creative behavior. Individuals are much more likely to engage in a task if they assume they will have a successful outcome. The motivation to succeed is high under such circumstances (104). Bandura also suggests the possibility of a relationship between creative behavior and self-efficacy (105). Based on this, we hypothesized that:

**Hypothesis 3:** *Creativity has a positive predictive effect on self-efficacy.*

There are several reasons why creativity can moderate the relationship between resilience and self-efficacy. First, creativity and its manifestation through unique art-making or problem-solving abilities have long been connected with divergent thinking (106). Metz posits that the ability to think creatively predicts resilience (107). Second, Bandura argues that innovation requires an unshakable sense of efficacy to persevere creatively; due to the involvement of high risks and multiple obstacles, one needs adequate self-efficacy to persist in creative work. Creative self-efficacy is also a necessary precursor of creative efforts (108). Although studies have explored the mechanisms underlying the inter-relationships between

creativity, resilience, and self-efficacy, few have explored the moderating role of creativity in these relationships. On this theoretical and empirical basis, the following hypothesis is proposed:

**Hypothesis 4:** *Creativity plays a moderating role in the relationship between psychological resilience and self-efficacy.*

The hypothetical model is shown in **Figure 1**.

## 3 Materials and methods

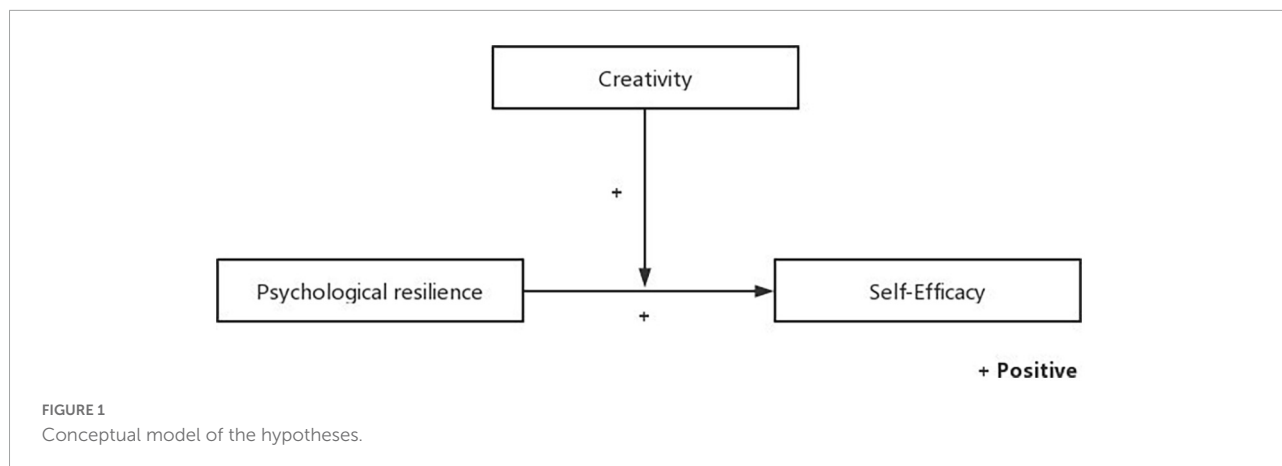
### 3.1 Participants and procedures

For this study, 918 participants were recruited from a polytechnical college in Guangdong Province, China, that had more than 20,000 full-time students. From them, we selected 19–21-year-olds as the survey respondents. The number was eventually reduced to 881 qualified participants, 317 males (35.982%) and 564 females (64.018%). Before the study design was finalized, we conducted exploratory focus-group interviews with the students to investigate their emotional characteristics and psychological state. Most interviewees said that they had experienced depression during the COVID-19 pandemic.

This study used a related design. We collected data through an online questionnaire that participants completed between April 10 and June 15, 2020. During the recess of an online course, consenting participants scanned a QR code that took them to the online questionnaire. (QR or Quick Response is a readable barcode that can be scanned with a mobile phone tablet or other device equipped with a camera to reach a specific link. In China, QR codes are widely used to for such functions as financial payment, verification of identity, and querying information). The purpose and utility of this study had earlier been introduced to the students in detail to ensure that they were participating on a voluntary basis.

### 3.2 Materials

The questionnaire used in this study consists of four parts: demographic information and three scales totaling 60 items that measured resilience, creativity, and self-efficacy. The scales used to measure resilience and general self-efficacy, originally developed in English, were translated into Chinese for this study. In order to improve the quality of the translation, we adopted the back-translation method: The first researcher translated the English text into Chinese, then the second researcher translated the Chinese text back into English. A third researcher compared the original version, the translated version, and the back-translated version of the scales to determine the accuracy of translation. Before finalizing the questionnaire, the



translated content was revised and optimized to ensure the equivalence of the scale. All questionnaires took a total of 10–15 min to complete.

### 3.2.1 Resilience scale for chinese adolescents

After reviewing relevant studies from Chinese and foreign sources, we selected the Resilience Scale for Chinese Adolescents (109). The scale has 27 items divided into five dimensions: Goal focus, emotional control, positive cognition, family support, and interpersonal assistance. Respondents are asked to rank the degree of their agreement with each statement on a five-point Likert scale ranging from one (totally disagree) to five (totally agree). For example, “I have a clear purpose in my life,” “I have difficulty controlling unpleasant emotions,” “I have a lot of mood swings and tend to have big ups and downs,” and “I think adversity is motivating.” In the study, the scale had a Cronbach’s alpha of 0.860.

### 3.2.2 General self-efficacy scale

A Chinese-language version of the General Self-Efficacy Scale was used in this study (110). The original scale contains 10 items. Combined with the specific situation of students and research needs, we removed the last three items after a group discussion, reducing the number of items to seven. The scale is rated on a four-point scale (one = completely 1 incorrect, four = completely correct). For example, “I can always solve problems if I try,” “I am confident that I can cope effectively with anything that comes my way,” and “I am able to face difficulties calmly because I trust my ability to deal with problems.” In this study, the internal consistency coefficient of the scale was 0.875.

### 3.2.3 Runco ideational behavior scale

A Chinese-language version of the Runco Ideational Behavior Scale was used in this study to measure creative ideation (111). The scale consists of 23 self-report items that measure the level of creative behaviors in daily life, using a five-point rating (one = strongly disagree, five = strongly agree). For example, “I have a lot of novel ideas,” “I can come up with

TABLE 1 Descriptive statistics for the three variables.

Variable	N	M	SD
Psychological resilience	881	3.4173	0.4431
Male	317	3.4524	0.4396
Female	564	3.3975	0.4447
Self-efficacy	881	2.3180	0.5370
Male	317	2.3074	0.5516
Female	564	2.3239	0.5295
Creativity	881	3.2487	0.5633
Male	317	3.2515	0.5602
Female	564	3.2472	0.5660

ideas or solutions that no one else has thought of,” and “I’m good at combining ideas in ways that no one else has tried before.” In this study, the scale had an internal consistency coefficient of 0.938.

## 3.3 Analysis of data

SPSS 26.0 was used for data processing and analysis in this study. To ensure the validity of these self-reported data, Harman’s single factor test (112) was used to check for common method biases before data processing. A total of 57 items in the questionnaire related to the three variables were tested. The results showed 10 factors with eigenvalues greater than 1. The contribution rate of the 10 factors to the total variance was 61.821%, and the explanation rate of the first factor was only 23.403%, which did not reach the critical standard of 40% (113). Hence, there was no significant common methodological bias in this study.

We next performed descriptive analysis, correlation analysis and model testing on the data based on the study hypotheses. First, we examined data centralization and dispersion. Then, we calculated Pearson’s correlation coefficients to

TABLE 2 Correlations among variables.

S. no	Variables	1	2
1.	Psychological resilience		
2.	Self-efficacy	0.2660***	
3.	Creativity	0.1980***	0.4750***

N = 881. \*\*\*p < 0.001.

test the relationships among the independent, dependent, and moderating variables. Using these results, we further investigated the research hypotheses. and used the SPSS PROCESS (version 4.0) plug-in to test the moderating effect of the model. (The PROCESS plugin was developed by Hayes. specifically for path-analysis-based moderation and mediation analysis and their combinations).

## 4 Results

### 4.1 Descriptive statistics and correlation analysis

Descriptive statistics and Pearson product moment correlation coefficients were calculated using SPSS 26.0. The results of the analysis are shown in **Tables 1, 2**.

It was found that resilience was positively correlated with creativity ( $r = 0.198, p < 0.001$ ) and self-efficacy ( $r = 0.266, p < 0.001$ ). The creativity of the participants was positively correlated with their self-efficacy ( $r = 0.4750, p < 0.001$ ). Therefore, the results of correlation analysis provided preliminary support for the subsequent test of the moderating effect.

### 4.2 The moderating analysis of creativity

We used Model 1 of the SPSS PROCESS plug-in to perform the multiple regression analysis, with resilience as the independent variable, self-efficacy as the dependent

variable, and creativity as the mediating variable. As shown in **Table 3**, resilience was significantly correlated with self-efficacy ( $\beta = 0.2159, SE = 0.0358, p < 0.001$ ), indicating that resilience had a significant impact on self-efficacy i.e., a higher level of resilience among college students predicted a stronger sense of self-efficacy. Creativity was significantly correlated with self-efficacy ( $\beta = 0.4333, SE = 0.0286, p < 0.001$ ); thus, creativity could significantly predict self-efficacy. The interaction of resilience and creativity was significant ( $\beta = 0.1698, SE = 0.0603, p < 0.01$ ), meaning that while resilience had an impact on self-efficacy, creativity also had an impact on self-efficacy at different levels. To investigate further, we used the bootstrap method to determine that the confidence intervals (at 95% confidence) for the interaction item between resilience and creativity on self-efficacy, [0.0515, 0.2881] did not contain a zero value. Therefore, the moderating model of psychological resilience and self-efficacy was established, with creativity as the moderating variable between psychological resilience and self-efficacy.

To further analyze the moderating effect of creativity, we divided the scores for creativity score into a low group ( $M - 1$  SD) and a high group ( $M + 1$  SD) before performing a simple slope analysis (see **Table 4**). The results showed that the 95% confidence intervals did not include a zero value, and that creativity affected the strength of the relationship between self-efficacy and creativity. When the score for creativity was high ( $M + 1$  SD), creativity was a stronger predictor of self-efficacy (see **Figures 2, 3**). When the value of creativity is greater than  $-0.652$ , the moderating effect shows a significant state and plays a positive role. At the same time, it can be seen from **Figure 3** that the moderating effects of creativity on resilience and self-efficacy have no negative effect, but only change the size of the influence.

## 5 Discussion

### 5.1 Summary of findings

In this study, we developed a moderating model to explore the relationship between resilience and self-efficacy among students during the COVID-19 pandemic, using a sample of

TABLE 3 Analysis of the moderating effect of creativity on self-efficacy.

Predictors	Self-efficacy					
	$\beta$	SE	t	p	95% CI (Lower)	95% CI (Upper)
Resilience	0.2159	0.0358	6.027***	0.0000	0.1456	0.2863
Creativity	0.4333	0.0286	15.1394***	0.0000	0.3771	0.4895
Resilience * creativity	0.1698	0.0603	2.8175**	0.0049	0.0515	0.2881
R <sup>2</sup>	0.2635					
F	104.5958***					

N = 881. \*\*p < 0.01; \*\*\*p < 0.001.

881 college students from a polytechnical college in Guangdong, China. We also investigated the potential moderating impact of creativity in this relationship. The results showed that (1) resilience was positively correlated with self-efficacy and creativity; (2) creativity was positively correlated with self-efficacy; (3) the interaction of resilience and creativity was positively correlated with self-efficacy, indicating that creativity had a significant moderating effect on resilience and self-efficacy. Specifically, when the creativity scores of participants were high, this effect was more significant.

These findings provide further evidence of the relationship between resilience and self-efficacy. They also demonstrate how resilience and creativity can enhance self-efficacy of college student following traumatic events during the COVID-19 pandemic. These results are in agreement with the hypotheses proposed in this study and in previous studies.

At this juncture, we appraise an overview of the above findings.

First of all, the results of this study are basically consistent with H1 and those appearing in previous studies, namely that there is a positive correlation between psychological resilience and self-efficacy (115, 116). Since a positive link can be expected between mental toughness and self-efficacy, adolescents may experience more self-efficacy during the COVID-19 pandemic if they have strong resilience. In a study of patients with diabetes-caused foot ulcers, factors such as self-efficacy were significantly higher for the high-resilience group than for the low-resilience group (117). Self-efficacy among college students enrolled in online courses was reflected in the completion of their courses, social and academic interactions with classmates, use of the course management system, and interaction with instructors (118). Resilience can be a key factor in the psychosocial care of patients (119), and college students who experience excessive negative emotions due to the COVID-19 pandemic can improve their self-efficacy through online learning platforms that promote adaptive development.

Secondly, the results of this study are in agreement with those of other similar studies: psychological resilience has a significant impact on creativity (120). In other words, people with mental toughness are likely to be more creative. When one examines the concepts of creativity and resilience, certain associations can be inferred (121). When one has

strong mental toughness, his or her problem-solving stamina and resistance to stress are at relatively higher levels, thus promoting creativity. The individual’s personality has an important influence on creativity, expressed mainly in his or her resilience in the face of obstacles and other imitations of courage and determination. A correlation between the social component of mental toughness and creativity can hence be inferred, with the former supported in the social environment and in social relationships that reinforce the involvement of creative activities.

The large number of natural and man-made disasters makes it imperative to confront and respond to crisis and trauma. In the social sciences, psychological resilience is understood as “the process of bending and bouncing back from adversity” (74). Similarly, creativity is essential for adaptation, adjustment, or problem solving (122). Contradictory traits, namely optimism vs. realism, logic vs. naivety, introversion vs. extroversion, can be defining characteristics of creative personalities (123, 124). A living mind links resilience and creativity, with people having strong resilience possessing the flexibility to adapt to specific situations; this flexibility allows them to express creativity. The findings in the present study imply that college students with strong resilience have the ability to respond to specific circumstances associated with the pandemic and they can recover from difficult situations through flexible thinking that reflects creativity. Their psychological resilience contributes to the molding of their personality, which in turn facilitates development of creativity. This may be more evident in the development of MINI-Cs, and the career Cs needed for future development. Thus, creative social engagement and psychological resilience support each other (125, 126).

Thirdly, these results are consistent with previous studies showing that, in line with H3, creativity has a positive effect on self-efficacy. As Bandura mentions, successful experiences increase self-efficacy; substitution or imitation also affects one’s self-efficacy, while direct experience or alternative experience based on one’s persuasion to oneself can increase one’s self-efficacy (53). Successful experiences, alternative experiences and imitation, and verbal persuasion need to be novel and practical in order to have an impact in this respect. Bandura hence contends that there is a significant correlation between the generation of creativity and discovery on the one hand, and strong self-efficacy on the other (53). Accordingly, the epiphanies required for these idea generation processes may be important in enhancing self-efficacies that arise in different domains. Self-efficacy is perceived and defined differently in different fields. The concept of “creative self-efficacy” refers to the self-evaluation of individuals when they are engaged in a specific task; in other words, it is their confidence in their ability to invent new products (99). The impact of creativity self-efficacy has been noted in entrepreneurship (127), small-business performance (128), employee performance (129), and other domains. Therefore, it would be possible for creative

TABLE 4 Conditional effects at specific levels of creativity.

Score for creativity	Estimate	SE	t	p	95%CI	
					Lower	Upper
- 1 SD	0.1202	0.0498	2.4153*	0.0159	0.0225	0.2179
M	0.2159	0.0358	6.027***	0.0000	0.1456	0.2863
+ 1 SD	0.3117	0.0490	6.3649***	0.0000	0.2156	0.4078

N = 881. \*p < 0.05; \*\*\*p < 0.001.

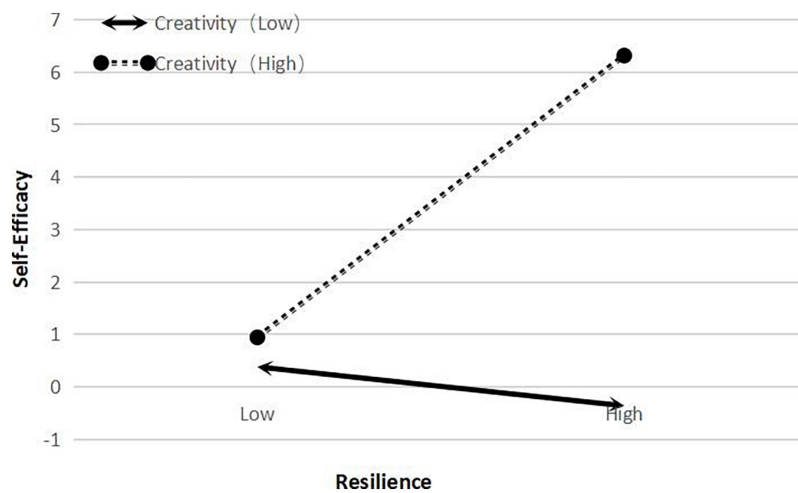


FIGURE 2 The relationship between resilience and self-efficacy for high and low scores for creativity.

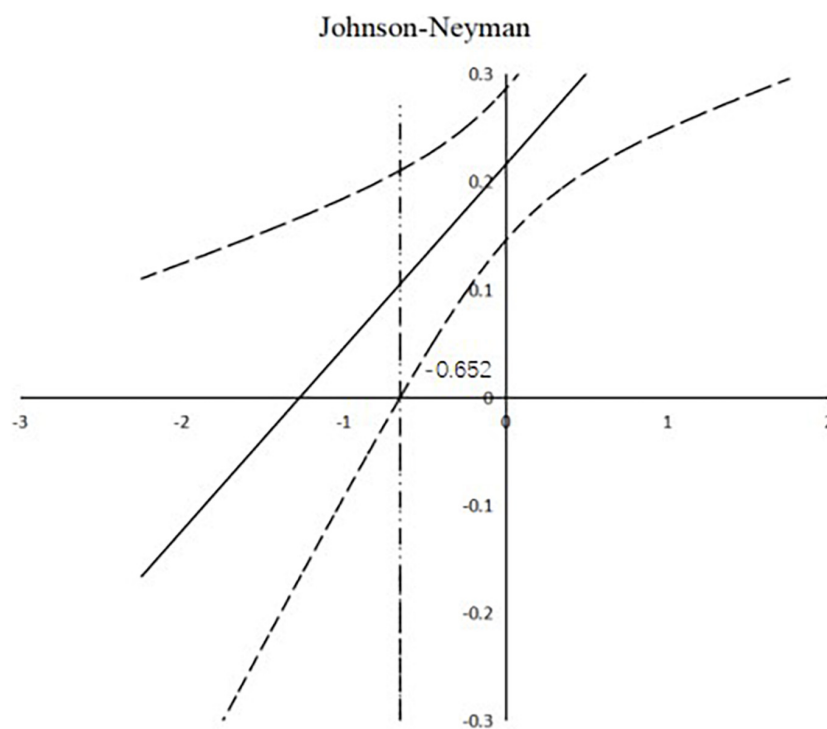


FIGURE 3 The relationship between resilience and self-efficacy for high and low scores for creativity, using the Johnson-Neyman technique (114).

college students to develop creative self-efficacy whereby they can strive to overcome difficulties experienced during the pandemic, and be confident and optimistic about themselves.

The COVID-19 pandemic had negatively impacted many components of students' development, including their predisposition to stress, anxiety, and depression. They experienced many negative emotions arising from

rumors and uncertainties that led to a decrease in their self-efficacy. However, those with positive creativity were able to counter these tendencies to engender positive experiences of success, alternative experiences, and imitation and verbal persuasion, which in turn, enhanced their self-efficacy. In this regard, creativity reflects tolerance and responsiveness to new environmental stimuli. Individuals with high creativity may be



more sensitive and responsive to pandemic-related events and react more positively.

Fourthly, the results from the present study corroborate H4: Creativity can mediate the relationship between resilience and self-efficacy. High resilience traits predict more creative thinking (130) and in the present study, self-efficacy was better predicted when creativity was higher (i.e.,  $M + 1$  SD) levels of creativity. Creative thinkers are more likely to change their minds and use multiple methods to solve problems instead of giving up, thus further improving their psychological resilience (131). Entrepreneurial activity is accelerated by higher self-efficacy, where the capacity to do a job creatively is fundamental to the individual's self-definition (132). Notwithstanding this, creativity can also play a negative role if creative thinking is too out-of-step with reality and practicality. In this connection, college students may be unable to adapt to certain pandemic situations, resulting in self-doubt and learned helplessness, traits which are not conducive to self-efficacy.

In this study, it can be seen that creativity moderates the relationship between mental toughness and self-efficacy to some extent. It hence plays a very important role in the relationship between psychological resilience and self-efficacy.

## 5.2 Theoretical contribution and practical significance

This study provides fresh insights into the psychological state of Chinese college students in the context of the COVID-19 pandemic. Previous studies tend to regard creativity as a dependent variable, leading to the testing the influence of psychological variables in different situations on creativity. In our study, creativity is regarded as a moderating variable in the relationship between resilience and self-efficacy, which reflects the psychological state of college students.

From the relationship between psychological resilience and self-efficacy, we can see that college students who were not afraid to face what happened after the pandemic had a higher sense of self-efficacy. They had more confidence in what they were doing because they were resilient to setbacks. Therefore, it is recommended that parents, teachers and school administrators stress the nurturing of resilience among young people.

At the same time, we found that higher creativity had a high impact on self-efficacy. If teachers taught college students to use creativity to adapt to challenges posed by the pandemic, they would help consolidate and strengthen the psychological resilience of students who would then have higher levels of self-efficacy that would be beneficial to their academic success and future career development. Therefore, parents, teachers and schools should pay attention to correct and positive guidance when exerting creative influence on college students, while being careful to avoid too much out-of-step thinking that can be counter-productive to the ability to adapt.

## 5.3 Limitations and future directions

There are some limitations in this study.

Firstly, as this is a cross-sectional study, we cannot infer cause and effect from the results or investigate the dynamic processes among the variables.

Secondly, all the participants were from one university. Due to the variations in the severity of outbreaks in different regions, the sample population was limited in representation, which may affect the validity of the results. Validity may also be affected by biases and influences such as social mobility.

Future researchers could use a longitudinal study design to enable long-term observation or expand the number and scope of participants, possibly selecting multiple data points from different college populations so as to make the results more generalizable. Future research could also address the optimization of the conceptual model. Another avenue of research is the exploration of other relevant moderating variables that may affect psychological resilience and self-efficacy.

## 6 Conclusion

We explored the relationships among the traits of psychological resilience, self-efficacy, and creativity in college students during the early stages of the COVID-19 pandemic. The results showed that resilience positively affected the self-efficacy and creativity of the participants. Creativity positively affected their self-efficacy as well. In addition, creativity moderated the relationship between resilience and self-efficacy. In other words, in the face of challenges posed by the COVID-19 pandemic (and possibly other crises), creativity is an important factor in enhancing college students' self-efficacy. The findings of this study reveal that the psychological problems that college students with high self-efficacy may encounter in stressful and crisis situations should be viewed from a new perspective on resilience and self-efficacy.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The ethical approval was obtained from the Ethics Committee of Capital Normal University. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

YX and GY designed the research. CY and JL carried out the literature review, data analysis, and wrote the manuscript. JZ was mainly responsible for data extraction and sorting. All authors have read and agreed to the submitted version of the manuscript.

## Funding

This research was funded by Beijing Office for Education Sciences Planning (Grant No. BGEA19039).

## Acknowledgments

We would like to thank the students who completed the questionnaire and contributed useful data to our research.

## References

- Fauci AS, Lane HC, Redfield RR. Covid-19 – navigating the uncharted. *N Engl J Med.* (2020) 382:1268–9. doi: 10.1056/NEJMe2002387
- Ciotti M, Ciccozzi M, Terrinoni A, Jiang WC, Wang CB, Bernardini S. The COVID-19 pandemic. *Crit Rev Clin Lab Sci.* (2020) 57:365–88. doi: 10.1080/10408363.2020.1783198
- Yuki K, Fujiogi M, Koutsogiannaki S. COVID-19 pathophysiology: a review. *Clin Immunol.* (2020) 215:108427. doi: 10.1016/j.clim.2020.108427
- Daniel SJ. Education and the COVID-19 pandemic. *Prospects (Paris).* (2020) 49:91–6. doi: 10.1007/s11125-020-09464-3
- González-Padilla DA, Tortolero-Blanco L. Social media influence in the COVID-19 pandemic. *Int Braz J Urol.* (2020) 46(Suppl. 1):120–4. doi: 10.1590/s1677-5538.ibju.2020.s121
- Zajacova A, Lynch SM, Espenshade TJ. Self-efficacy, stress, and academic success in college. *Res High Educ.* (2005) 46:677–706. doi: 10.1007/s11162-004-4139-z
- Shi Y, Wang G, Cai XP, Deng JW, Zheng L, Zhu HH, et al. An overview of COVID-19. *J Zhejiang Univ Sci B.* (2020) 21:343–60. doi: 10.1631/jzus.B2000083
- Luthar SS, Cicchetti D. The construct of resilience: implications for interventions and social policies. *Dev Psychopathol.* (2000) 12:857–85. doi: 10.1017/S0954579400004156
- Killgore WDS, Taylor EC, Cloonan SA, Dailey NS. Psychological resilience during the COVID-19 lockdown. *Psychiatry Res.* (2020) 291:113216. doi: 10.1016/j.psychres.2020.113216
- Meredith LS, Sherbourne CD, Gaillot SJ, Hansell L, Ritschard HV, Parker AM, et al. Promoting psychological resilience in the U.S. Military. *Rand Health Q.* (2011) 1:2.
- Windle G, Woods RT, Markland DA. Living with ill-health in older age: the role of a resilient personality. *J Happ Stud.* (2009) 11:763–77. doi: 10.1007/s10902-009-9172-3
- Shen K, Zeng Y. The association between resilience and survival among Chinese elderly. *Demogr Res.* (2010) 23:105–16. doi: 10.4054/DemRes.2010.23.5
- Howell KH, Miller-Graff LE, Schaefer LM, Scrafford KE. Relational resilience as a potential mediator between adverse childhood experiences and prenatal depression. *J Health Psychol.* (2020) 25:545–57. doi: 10.1177/1359105317723450
- Abiola T, Udofia O. Psychometric assessment of the Wagnild and young's resilience scale in Kano, Nigeria. *BMC Res Notes.* (2011) 4:509. doi: 10.1186/1756-0500-4-509
- Beghetto RA, Kaufman JC. Toward a broader conception of creativity: a case for “mini-c” creativity. *Psychol Aesthet Creat Arts.* (2007) 1:73–9. doi: 10.1037/1931-3896.1.2.73
- Kapoor H, Kaufman JC. Meaning-making through creativity during COVID-19. *Front Psychol.* (2020) 11:595990. doi: 10.3389/fpsyg.2020.595990
- Thanh Le T, Andreadakis Z, Kumar A, Gomez Roman R, Tollefsen S, Saville M, et al. The COVID-19 vaccine development landscape. *Nat Rev Drug Discov.* (2020) 19:305–6. doi: 10.1038/d41573-020-00073-5
- Sternberg RJ, Lubart TI. Investing in creativity. *Am Psychol.* (1996) 51:677–88. doi: 10.1037/0003-066X.51.7.677
- Rhodes M. An analysis of creativity. *Phi Delta Kappan.* (1961) 42:305–10.
- Rutter M. Psychosocial resilience and protective mechanisms. *Am J Orthopsychiatry.* (1987) 57:316–31. doi: 10.1111/j.1939-0025.1987.tb03541.x
- Tedeschi RG, Calhoun LG. *Trauma & Transformation: Growing in the Aftermath of Suffering.* Thousand Oaks, CA: Sage Publications, Inc (1995). doi: 10.4135/9781483326931
- Werner EE. Vulnerable but invincible: high-risk children from birth to adulthood. *Acta Paediatr Suppl.* (1997) 422:103–5. doi: 10.1111/j.1651-2227.1997.tb18356.x
- Vieira ET, Grantham S. University students setting goals in the context of autonomy, self-efficacy and important goal-related task engagement. *Educ Psychol.* (2011) 31:141–56. doi: 10.1080/01443410.2010.536508
- Luszczynska A, Gibbons FX, Piko BF, Tekozel M. Self-regulatory cognitions, social comparison, and perceived peers' behaviors as predictors of nutrition and physical activity: a comparison among adolescents in Hungary, Poland, Turkey, and USA. *Psychol Health.* (2004) 19:577–93. doi: 10.1080/088704402000205844
- Warner LM, Schuz B, Wurm S, Ziegelmann JB, Tesch-Romer C. Giving and taking—differential effects of providing, receiving and anticipating emotional support on quality of life in adults with multiple illnesses. *J Health Psychol.* (2010) 15:660–70. doi: 10.1177/1359105310368186
- Coleman PK, Karraker KH. Self-efficacy and parenting quality: findings and future applications. *Dev Rev.* (1998) 18:47–85. doi: 10.1006/drev.1997.0448
- Cheever KH, Hardin SB. Effects of traumatic events, social support, and self-efficacy on adolescents' self-health assessments. *West J Nurs Res.* (1999) 21:673–84. doi: 10.1177/01939459922044117

We would also like to thank those who assisted with language revision.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

28. Harvey J, Delfabbro PH. Psychological resilience in disadvantaged youth: a critical overview. *Aust Psychol.* (2007) 39:3–13. doi: 10.1080/00050060410001660281
29. Fletcher D, Sarkar M. A grounded theory of psychological resilience in Olympic champions. *Psychol Sport Exerc.* (2012) 13:669–78. doi: 10.1016/j.psychsport.2012.04.007
30. Fletcher D, Sarkar M. Psychological resilience. *Eur Psychol.* (2013) 18:12–23. doi: 10.1027/1016-9040/a000124
31. Bonanno GA. Loss, trauma, and human resilience: have we underestimated the human capacity to thrive after extremely aversive events? *Am Psychol.* (2004) 59:20–8. doi: 10.1037/0003-066X.59.1.20
32. Tugade MM, Fredrickson BL. Resilient individuals use positive emotions to bounce back from negative emotional experiences. *J Pers Soc Psychol.* (2004) 86:320–33. doi: 10.1037/0022-3514.86.2.320
33. Campbell-Sills L, Cohan SL, Stein MB. Relationship of resilience to personality, coping, and psychiatric symptoms in young adults. *Behav Res Ther.* (2006) 44:585–99. doi: 10.1016/j.brat.2005.05.001
34. Gu Q, Day C. Teachers resilience: a necessary condition for effectiveness. *Teach Teach Educ.* (2007) 23:1302–16. doi: 10.1016/j.tate.2006.06.006
35. Bogar CB, Hulse-Killackey D. Resiliency determinants and resiliency processes among female adult survivors of childhood sexual abuse. *J Counsel Dev.* (2006) 84:318–27. doi: 10.1002/j.1556-6678.2006.tb00411.x
36. Kidd S, Shahar G. Resilience in homeless youth: the key role of self-esteem. *Am J Orthopsychiatry.* (2008) 78:163–72. doi: 10.1037/0002-9432.78.2.163
37. Zautra AJ, Johnson LM, Davis MC. Positive affect as a source of resilience for women in chronic pain. *J Consult Clin Psychol.* (2005) 73:212–20. doi: 10.1037/0022-006X.73.2.212
38. Rutter M. Implications of resilience concepts for scientific understanding. *Ann N Y Acad Sci.* (2006) 1094:1–12. doi: 10.1196/annals.1376.002
39. Masten AS. Ordinary magic. Resilience processes in development. *Am Psychol.* (2001) 56:227–38. doi: 10.1037/0003-066X.56.3.227
40. Connor KM, Davidson JR. Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC). *Depress Anxiety.* (2003) 18:76–82. doi: 10.1002/da.10113
41. Agaibi CE, Wilson JP. Trauma, PTSD, and resilience: a review of the literature. *Trauma Viol Abuse.* (2005) 6:195–216. doi: 10.1177/1524838005277438
42. Rutter M. Resilience in the face of adversity. Protective factors and resistance to psychiatric disorder. *Br J Psychiatry.* (1985) 147:598–611. doi: 10.1192/bjp.147.6.598
43. Roy P, Rutter M, Pickles A. Institutional care: risk from family background or pattern of rearing? *J Child Psychol Psychiatry.* (2000) 41:139–49. doi: 10.1017/S002196309900517X
44. Tschann JM, Kaiser P, Chesney MA, Alkon A, Boyce WT. Resilience and vulnerability among preschool children: family functioning, temperament, and behavior problems. *J Am Acad Child Adolesc Psychiatry.* (1996) 35:184–92. doi: 10.1097/00004583-199602000-00012
45. Carver CS. Resilience and thriving: issues, models, and linkages. *J Soc Issues.* (1998) 54:245–66. doi: 10.1111/j.1540-4560.1998.tb01217.x
46. Floyd C. Achieving despite the odds: a study of resilience among a group of African American high school seniors. *J Negro Educ.* (1996) 65:181–9. doi: 10.2307/2967312
47. Smokowski PR. Prevention and intervention strategies for promoting resilience in disadvantaged children. *Soc Serv Rev.* (1998) 72:337–64. doi: 10.1086/515762
48. Smokowski PR, Reynolds AJ, Bezruczko N. Resilience and protective factors in adolescence. *J School Psychol.* (1999) 37:425–48. doi: 10.1016/S0022-4405(99)00028-X
49. Carbonell DM, Reinherz HZ, Giaconia RM. Risk and resilience in late adolescence. *Child Adolesc Soc Work J.* (1998) 15:251–72. doi: 10.1023/A:1025107827111
50. Windle G, Markland DA, Woods RT. Examination of a theoretical model of psychological resilience in older age. *Aging Ment Health.* (2008) 12:285–92. doi: 10.1080/13607860802120763
51. de Terte I, Stephens C. Psychological resilience of workers in high-risk occupations. *Stress Health.* (2014) 30:353–5. doi: 10.1002/smi.2627
52. Parsons S, Kruijt A-W, Fox E. A cognitive model of psychological resilience. *J Exp Psychopathol.* (2016) 7:296–310. doi: 10.5127/jep.053415
53. Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev.* (1977) 84:191–215. doi: 10.1037/0033-295X.84.2.191
54. Bandura A. Self-efficacy: the exercise of control. *J Cogn Psychother.* (1999) 13:158–66. doi: 10.1891/0889-8391.13.2.158
55. Maddux JE. Self-efficacy theory: an introduction. In: Maddux JE editor. *Self-Efficacy, Adaptation, and Adjustment: Theory, Research, and Application.* New York, NY: Plenum Press (1995). p. 3–33. doi: 10.1007/978-1-4419-6868-5\_1
56. Schunk DH, Hanson AR. Peer models: influence on children's self-efficacy and achievement. *J Educ Psychol.* (1985) 77:313–22. doi: 10.1037/0022-0663.77.3.313
57. Zimmerman B. Self-efficacy and educational development. In: Bandura A editor. *Self-Efficacy in Changing Societies.* Cambridge: Cambridge University (1995). p. 46–68. doi: 10.1017/CBO9780511527692.009
58. Schunk DH, Pajares F. Competence perceptions and academic functioning. In: Elliot AJ, Dweck CS editors. *Handbook of Competence and Motivation.* New York, NY: Guilford Publications (2005). p. 85–104.
59. Usher EL, Pajares F. Sources of self-efficacy in school: critical review of the literature and future directions. *Rev Educ Res.* (2008) 78:751–96. doi: 10.3102/0034654308321456
60. Lent RW, Lopez FG, Bieschke KJ. Mathematics self-efficacy: sources and relation to science-based career choice. *J Counsel Psychol.* (1991) 38:424–30. doi: 10.1037/0022-0167.38.4.424
61. Britner SL, Pajares F. Sources of science self-efficacy beliefs of middle school students. *J Res Sci Teach.* (2006) 43:485–99. doi: 10.1002/tea.20131
62. Smith SM. The four sources of influence on computer self-efficacy. *Delta Pi Epsilon J.* (2001) 43:27–39.
63. Usher EL, Pajares FM. Inviting confidence in school: invitations as a critical source of the academic self-efficacy beliefs of entering middle school students. *J Invitat Theory Pract.* (2006) 12:7–16.
64. Usher EL, Pajares F. Sources of academic and self-regulatory efficacy beliefs of entering middle school students. *Contemp Educ Psychol.* (2006) 31:125–41. doi: 10.1016/j.cedpsych.2005.03.002
65. Matsui T, Matsui K, Ohnishi R. Mechanisms underlying math self-efficacy learning of college students. *J Vocat Behav.* (1990) 37:225–38. doi: 10.1016/0001-8791(90)90042-Z
66. Klassen RM. A cross-cultural investigation of the efficacy beliefs of South Asian immigrant and Anglo Canadian nonimmigrant early adolescents. *J Educ Psychol.* (2004) 96:731–42. doi: 10.1037/0022-0663.96.4.731
67. Hampton NZ, Mason E. Learning disabilities, gender, sources of efficacy, self-efficacy beliefs, and academic achievement in high school students. *J School Psychol.* (2003) 41:101–12. doi: 10.1016/S0022-4405(03)00028-1
68. Kreauskon P, Gellert P, Lippke S, Schwarzer R. Planning and self-efficacy can increase fruit and vegetable consumption: a randomized controlled trial. *J Behav Med.* (2012) 35:443–51. doi: 10.1007/s10865-011-9373-1
69. Albani C, Bailer H, Blaser G, Geyer M, Braehler E, Grulke N. [Religious and spiritual beliefs - validation of the German version of the "systems of belief inventory" (SBI-15R-D) by Holland et al. in a population-based sample]. *Psychother Psychosom Med Psychol.* (2002) 52:306–13. doi: 10.1055/s-2002-32863
70. Patrick C. Creative thought in poets. *Arch Psychol.* (1935) 178:1–74.
71. Patrick C. Creative thought in artists. *J Psychol.* (1937) 4:35–73. doi: 10.1080/00223980.1937.9917525
72. Patrick C. Scientific thought. *J Psychol.* (1938) 5:55–83. doi: 10.1080/00223980.1938.9917552
73. Plucker JA, Beghetto RA, Dow GT. Why isn't creativity more important to educational psychologists? Potentials, pitfalls, and future directions in creativity research. *Educ Psychol.* (2004) 39:83–96. doi: 10.1207/s15326985sep3902\_1
74. Xu Y, Shao J, Zeng W, Wu X, Huang D, Zeng Y, et al. Depression and creativity during COVID-19: psychological resilience as a mediator and deliberate rumination as a moderator. *Front Psychol.* (2021) 12:665961. doi: 10.3389/fpsyg.2021.665961
75. Guilford JP. Creativity. *Am Psychol.* (1950) 5:444–54. doi: 10.1037/h0063487
76. Stein MI. Creativity and culture. *J Psychol.* (1953) 36:311–22. doi: 10.1080/00223980.1953.9712897
77. Lubart TI. *Product-Centered Self-Evaluation and the Creative Process.* New Haven, CT: Yale University (1994).
78. Ochse R. *Before the Gates of Excellence: The Determinants of Creative Genius.* New York, NY: Cambridge University Press (1990).
79. Howe MJA. The nature of creativity: contemporary psychological perspectives. Robert J. Sternberg (ed.). Cambridge University Press, 1988. No. of pages 464. ISBN 0 521 33036X (hard cover) and 0521 338921 (paperback). Price: £40 and £15 respectively. *Appl Cogn Psychol.* (1990) 4:145–6. doi: 10.1002/acp.2350040207

80. Sternberg RJ, Lubart TI. An investment theory of creativity and its development. *Hum Dev.* (1991) 34:1–31. doi: 10.1159/000277029
81. Sternberg RJ, Lubart T. *Defying the Crowd: Cultivating Creativity in a Culture of Conformity*. New York, NY: Free Press (1995).
82. Collins MA, Amabile TM. Motivation and creativity. In: Sternberg RJ editor. *Handbook of Creativity*. New York, NY: Cambridge University Press (1999). p. 297–312. doi: 10.1017/CBO9780511807916.017
83. Sternberg RJ, Lubart TI. “The concept of creativity: prospects and paradigms. In: Sternberg RJ editor. *Handbook of Creativity*. Cambridge: Cambridge University Press (1998). p. 3–15. doi: 10.1017/CBO9780511807916.003
84. Feist GJ, Runco MA. Trends in the creativity literature: an analysis of research in the journal of creative behavior (1967–1989). *Creat Res J.* (1993) 6:271–83. doi: 10.1080/10400419309534483
85. Amabile TM. A model of creativity and innovation in organizations. *Res Organ Behav.* (1988) 10:154.
86. Amabile TM, Collins MA, Conti R, Phillips E, Picariello M, Ruscio J, et al. *Creativity in Context: Update to the Social Psychology of Creativity*. Milton Park: Routledge (2018). doi: 10.4324/9780429501234
87. Kaufman JC, Beghetto RA. Beyond big and little: the four C model of creativity. *Rev Gen Psychol.* (2009) 13:1–12. doi: 10.1037/a0013688
88. Gielen PJD. *The Murmuring of the Artistic Multitude*. Amsterdam: Fontys (2009).
89. Gill R, Pratt A. In the social factory? *Theory Cult Soc.* (2008) 25:1–30. doi: 10.1177/0263276408097794
90. Van Winkel C, Gielen P, Zwaan K. *De Hybride Kunstenaar: de Organisatie van de Artistieke Praktijk in het Postindustriële Tijdperk*. Amsterdam: Hogeschool Inholland (2012).
91. Newfield C. Richard sennett. *The Culture of the New Capitalism*. New Haven, Conn.: Yale University Press, 2006. 214 pp. ISBN 0-300-10782-X, \$25.00 (paper). *Enterprise Soc.* (2006) 7:816–8. doi: 10.1017/S146722270000481X
92. Leana CR. The corrosion of character: the personal consequences of work in the New Capitalism. *Acad Manage Rev.* (2000) 25:252–3. doi: 10.5465/amr.2000.2791614
93. Virno P. *A Grammar of the Multitude*. London: Semiotext (e) (2003).
94. Schmitt L, Buisine S, Chaboissier J, Aoussat A, Vernier F. Dynamic tabletop interfaces for increasing creativity. *Comput Hum Behav.* (2012) 28:1892–901. doi: 10.1016/j.chb.2012.05.007
95. Chessick RD. Creativity and the sense of self: a review essay. *Am J Psychoanal.* (1996) 56:337–42. doi: 10.1007/BF02742419
96. Huisman M, Klokgieters SS, Beekman ATF. Successful ageing, depression and resilience research; a call for a priori approaches to investigations of resilience. *Epidemiol Psychiatr Sci.* (2017) 26:574–8. doi: 10.1017/S2045796017000348
97. Hao N, Lu K, Cheng R. The effect of anger on malevolent creativity and strategies for its emotion regulation. *Acta Psychol Sin.* (2021) 53:847–60. doi: 10.3724/SP.J.1041.2021.00847
98. Humke C, Schaefer CE. Sense of humor and creativity. *Percept Motor Skills.* (1996) 82:544–6. doi: 10.2466/pms.1996.82.2.544
99. Zhuravlyova I, Zhuravlyov SI. Humanistic sense of creativity in professional university education: the role of creativity in forming innovation model and modernization of university training. *Proc Soc Behav Sci.* (2015) 206:445–54. doi: 10.1016/j.sbspro.2015.10.081
100. Tierney P, Farmer SM. Creative self-efficacy: its potential antecedents and relationship to creative performance. *Acad Manage J.* (2002) 45:1137–48. doi: 10.2307/3069429
101. Beghetto R. Creative self-efficacy: correlates in middle and secondary students. *Creat Res J.* (2006) 18:447–57. doi: 10.1207/s15326934crj1804\_4
102. Feldhusen JF, Treffinger DJ. *Creative Thinking and Problem Solving in Gifted Education*. Dubuque, IA: Kendall/Hunt Pub. Co (1980).
103. Torrance EP. *Guiding Creative Talent*. Englewood Cliffs, NJ: Prentice-Hall, Inc (1962). doi: 10.1037/13134-000
104. Torrance EP. *Education and the Creative Potential*. Minneapolis, MN: University of Minnesota Press (1963).
105. Torrance EP. Teaching for creativity. In: Isaksen SG editor. *Frontiers in Creativity Research: Beyond the Basics*. Buffalo, NY: Bearly Limited (1987). p. 189–215.
106. Haase J, Hoff EV, Hanel PHP, Innes-Ker Å. A meta-analysis of the relation between creative self-efficacy and different creativity measurements. *Creat Res J.* (2018) 30:1–16. doi: 10.1080/10400419.2018.1411436
107. Bandura A. Exercise of human agency through collective efficacy. *Curr Direct Psychol Sci.* (2016) 9:75–8. doi: 10.1111/1467-8721.00064
108. Runco MA. Divergent thinking, creativity, and giftedness. *Gifted Child Q.* (1993) 37:16–22. doi: 10.1177/001698629303700103
109. Metzler ES. The role of creative thinking in resilience after hurricane Katrina. *Psychol Aesthet Creat Arts.* (2009) 3:112–23. doi: 10.1037/a0013479
110. Brislin RW. Back-translation for cross-cultural research. *J Cross Cult Psychol.* (1970) 1:185–216. doi: 10.1177/135910457000100301
111. Hu Y-Q, Gan Y-Q. Development and psychometric validity of the resilience scale for Chinese adolescents. *Acta Psychol Sin.* (2008) 40:902–12. doi: 10.3724/SP.J.1041.2008.00902
112. Schwarzer R, Bäßler J, Kwiatek P, Schröder K, Zhang JX. The assessment of optimistic self-beliefs: comparison of the German, Spanish, and Chinese versions of the general self-efficacy scale. *Appl Psychol.* (1997) 46:69–88. doi: 10.1111/j.1464-0597.1997.tb01096.x
113. Runco MA, Plucker JA, Lim W. Development and psychometric integrity of a measure of ideational behavior. *Creat Res J.* (2001) 13:393–400. doi: 10.1207/S15326934CRJ1334\_16
114. Johnson P, Neyman J. Tests of certain linear hypotheses and their application to some educational problems. *Statist Res Memoirs.* (1936) 1:57–93.
115. Podsakoff PM, MacKenzie SB, Lee JY, Podsakoff NP. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J Appl Psychol.* (2003) 88:879–903. doi: 10.1037/0021-9010.88.5.879
116. Zhou Hao LL. Statistical remedies for common method biases. *Adv Psychol Sci.* (2004) 12:942–50.
117. Martin AJ, Marsh HW. Academic resilience and its psychological and educational correlates: a construct validity approach. *Psychol Schools.* (2006) 43:267–81. doi: 10.1002/pits.20149
118. Kuang D, Gu DF, Cao H, Yuan QF, Dong ZX, Yu D, et al. Impacts of psychological resilience on self-efficacy and quality of life in patients with diabetic foot ulcers: a prospective cross-sectional study. *Ann Palliat Med.* (2021) 10:5610–8. doi: 10.21037/apm-21-967
119. Al Eid NA, Alqahtani MM, Marwa K, Arnout BA, Alswailem HS, Al Toaimi AA. Religiosity, psychological resilience, and mental health among breast cancer patients in kingdom of Saudi Arabia. *Breast Cancer (Auckl).* (2020) 14:1178223420903054. doi: 10.1177/1178223420903054
120. Shen D, Cho M-H, Tsai C-L, Marra R. Unpacking online learning experiences: online learning self-efficacy and learning satisfaction. *Intern High Educ.* (2013) 19:10–7. doi: 10.1016/j.iheduc.2013.04.001
121. Molina Y, Yi JC, Martinez-Gutierrez J, Reding KW, Yi-Frazier JP, Rosenberg AR. Resilience among patients across the cancer continuum: diverse perspectives. *Clin J Oncol Nurs.* (2014) 18:93–101. doi: 10.1188/14.CJON.93-101
122. Metzler ES, Morrell MA. The role of creativity in models of resilience: theoretical exploration and practical applications. *J Creat Ment Health.* (2008) 3:303–18. doi: 10.1080/15401380802385228
123. Hunter AJ. A cross-cultural comparison of resilience in adolescents. *J Pediatr Nurs.* (2001) 16:172–9. doi: 10.1053/jpdn.2001.24180
124. Evans KJ. Adaptors and innovators: styles of creativity and problem-solving. *J Operat Res Soc.* (1990) 41:789. doi: 10.2307/2583490
125. Hertzog C., Kramer AF, Wilson RS, Lindenberger U. Enrichment effects on adult cognitive development: can the functional capacity of older adults be preserved and enhanced? *Psychol Sci Public Interest.* (2008) 9:1–65. doi: 10.1111/j.1539-6053.2009.01034.x
126. McFadden SH, Basting AD. Healthy aging persons and their brains: promoting resilience through creative engagement. *Clin Geriatr Med.* (2010) 26:149–61. doi: 10.1016/j.cger.2009.11.004
127. Csikszentmihalyi M. *Creativity: Flow and the Psychology of Discovery and Invention*. New York, NY: HarperCollins Publishers (1997).
128. Gardner H, Gardner E. *Art, Mind, and Brain: A Cognitive Approach to Creativity*. New York, NY: Basic Books (2008).
129. Ahlin B, Drnovšek M, Hisrich RD. Entrepreneurs’ creativity and firm innovation: the moderating role of entrepreneurial self-efficacy. *Small Bus Econ.* (2013) 43:101–17. doi: 10.1007/s11187-013-9531-7
130. Liang Y, Zheng H, Cheng J, Zhou Y, Liu Z. Associations between posttraumatic stress symptoms, creative thinking, and trait resilience among Chinese adolescents exposed to the Lushan earthquake. *J Creat Behav.* (2020) 55:362–73. doi: 10.1002/jocb.460
131. Seale JK, Nind M, Simmons B. Transforming positive risk-taking practices: the possibilities of creativity and resilience in learning disability contexts. *Scand J Disabil Res.* (2013) 15:233–48. doi: 10.1080/15017419.2012.703967
132. Jaussi KS, Randel AE, Dionne SD. I Am, i think i can, and i do: the role of personal identity, self-efficacy, and cross-application of experiences in creativity at work. *Creat Res J.* (2007) 19:247–58. doi: 10.1080/10400410701397339