

## **The Impact of Critical Thinking on Postgraduate's Creativity in China: The Mediator of Self-Efficacy**

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### **ABSTRACT**

The purpose of this study is to explore the influence of critical thinking on graduate students' creativity in the context of self-efficacy, and to explore the relationship between the three variables by questionnaire. In this study, 150 questionnaires were sent out, and 126 effective questionnaires were collected. The effective questionnaire rate was 84%. The reliability and validity of the scale are all up to the standard of academic research. SPSS 24.0 was used as the measurement tool, and the results showed that as follow. Critical thinking positively influences creativity. Critical thinking positively influences self-efficacy. Self-efficacy positively influences creativity. Self-efficacy has intermediary effect between critical thinking and creativity.

This study has a certain contribution to the academic field of research on the influence of critical thinking on creativity, and uses self-efficacy as an intermediary variable to explore the relationship between graduate students' critical thinking and creativity, and puts forward relevant suggestions for future researchers.

**Keywords:** *postgraduate; critical thinking; creativity; self-efficacy*

### **INTRODUCTION**

With the development of knowledge economy, talents and innovation have become more and more important productive forces for the development of society, economy and science and technology. As a high-level talent, graduate students are getting more and more attention from all over the world. The reason is not only that graduate students play an important role in social development as a high-level talent, but also that the creativity of graduate students promotes the development of high and new technology. Therefore, graduate students become an important part of national and even world innovation system. Relevant research shows that postgraduates are the new force of scientific and technological innovation, and their creativity directly affects the innovation ability of the country (Wang et al., 2020). The quality and level

of graduate education has become an important factor reflecting the overall level of professional and technical teams in a country or region.

Creativity is the fire of innovation. To some extent, creativity is the crystallization of creative thinking and critical thinking. Critical thinking and creativity, as two of the most important abilities in the 21st century, have been the focus of research since they were put forward. The key to the quality of graduate education is to cultivate graduate students' critical thinking and enhance their creativity. Although some researches involve the influencing factors of graduate students' creativity, the mechanism of critical thinking influencing graduate students' creativity is still insufficient. Is critical thinking directly influencing graduate students' creativity? Or does critical thinking affect graduate students' creativity through mediating variables? According to critical thinking theory and self-efficacy theory, individual critical thinking will have a positive and direct impact on creativity, and critical thinking can have an indirect impact on creativity through self-efficacy. Therefore, it is of great practical significance to analyze the influencing factors of creativity and to explore the influencing mechanism of critical thinking on the creativity of postgraduates.

### **JOURNALS REVIEWED**

Based on the above research motivation, background and related literature analysis, the literature review of this study is divided into three parts: critical thinking, self-efficacy and creativity.

Critical thinking is a complex and comprehensive high-level thinking process. When critical thinking is carried out, it can be based on the internal value criteria, consider the problems, discuss the context, and make evaluation and analysis as the basis for decision-making. On the whole, it is a complex of knowledge, intention and ability. Critical thinking is a kind of judgment based on questioning (Face et al, 1997; Jiang et al, 2015), and also a kind of rational reflection thinking to decide what to believe (do) (Ennis, 1987). Critical thinking has four characteristics: introspection, curiosity, openness and systematization (Ye Yuzhu, 1999; Facione et al, 1997). Among them, introspection refers to the good consciousness of introspection, through analysis, interpretation, inference and interpretation to evaluate the quality of one's own or other's views (Feixiwan et al., 2009). Curiosity refers to the individual's desire or desire for new information and knowledge. Driven by curiosity, the individual experiences and breeds innovative behaviors (Litman, 2005). Openness refers to taking a tolerant attitude towards different opinions and preventing the possibility of personal prejudice (Faceone et al, 1997). Systematic individuals are good at recognizing and grasping work as a whole. Derek Bok, a former president of Harvard University, believes that the primary goal of university education is to develop students' ability to think critically (Derek Bok, 2008). In addition, according to the research data, 99% of university professors believe that it is necessary to develop students' critical thinking ability (Arum & Roksa, 2011), so it is one of the important missions of higher education institutions to cultivate students with critical thinking ability.

Self efficacy refers to the individual's belief in their ability to successfully complete tasks, which reflects the individual's confidence in completing tasks (Bandura 1977). It is an individual's confidence and belief on whether his behavior and performance level can successfully achieve the expected goal, which is a subjective evaluation of the individual and has the characteristics of guiding individual action. This confidence and belief is the internal process of synthesizing individual cognition, society and behavior into actual behavior. With the growth of individuals, self-efficacy will change, which may be stronger but also weaker.

Since Bandura put forward the concept of "self-efficacy" in social learning theory in 1986, it has been widely used in various fields of society. The common research fields of self-efficacy include: medical health, health care, education and teaching, employee management, etc., and the research objects include: students, teachers, administrators, medical staff, principals, enterprise employees, enterprises Home, volunteers and so on, because of the different subjects, the understanding and definition of self-efficacy are inconsistent, but the research results of all kinds of subjects show that self-efficacy and creativity are significantly related( Judge & Bono,2001; Kickul& D'Intino,2005; Tai,2006; Chiu, 2009; McConney et all,2014;Bakker et all, 2015; Adewale & Ghavifekr, 2019.).

The development of Postgraduates' creativity is the core goal of innovative personnel training mode. Creativity is a new, original, useful and correct result, such as knowledge, thought, product, process, tool, method, answer, etc., produced by the interaction of situational factors and individual factors in exploratory tasks. Creativity is usually the spark of the creator in the process of free exploration and independent thinking, the return of the creator's dedication and unremitting efforts, the brave breakthrough made by the creator in knowledge or technology, and the realization of the creator's dream in the pursuit of interest and confusion.

As early as the 1950s, the famous American psychologist Guilford proposed that creativity refers to the generation of new ideas (Guilford, 1950). But creativity is more than that. The academic community thinks that creativity refers to the generation of high-quality, original and excellent problem-solving solutions. "Creativity" and "innovation" are both related and different. The process of processing creative problem-solving solutions into new products, new processes, or new services is generally called innovation. Therefore, new products, new processes or new services can only be realized after creative problem-solving solutions are put forward first, that is to say, creativity is a necessary condition for innovation. After the research of individual creativity continues to deepen, the research of team creativity becomes more and more meaningful. The early study of creativity originated from the field of psychology, and the focus of research is the influence of individual differences on creativity. Since the 1990s, organizational behavior scholars have also paid more attention to creativity.

## **RESEARCH METHOD**

Based on the above-mentioned literature, the research hypotheses, experimental design, research methods and framework of this study are listed as follows.

## **Hypothesis**

According to the theory of self-determination, individuals with critical thinking are usually good at questioning, and prove their views by seeking evidence and logical reasoning. This process can satisfy the autonomy of graduate students, strengthen their internal motivation effectively, and promote their creativity. Critical thinking has been widely concerned by the educational community. It originated from the emphasis on thinking ability in the United States after the 1970s. Many schools later took cultivating students' critical thinking as their own goal (Paul, 1990). In the 21st century, universities at home and abroad all think that the cultivation of students' critical thinking ability should be taken as the goal, so that now critical thinking has become a necessary ability for today's college students (Richard P. K., 2004).

With the deepening of the research on critical thinking, many experts and scholars at home and abroad have verified that critical thinking has a significant predictive effect on creativity through empirical research, and found that critical thinking has a positive impact on creativity, and critical thinking can promote the creativity of employees and teams, in which critical thinking can be used as an independent variable of creativity, but also has a role in regulating creativity ( Jiang Jing 2019, hamzehie, A., & Bagheri, m.2018, Osman Pepe 2018, Shirazi, F. & heidari, S. 2019). However, most of the research objects are enterprise employees and middle school students, and few are graduate students. Therefore, this study proposes the following hypothesis:

H1 critical thinking has a significant impact on graduate students' creativity.

Critical thinking can promote the formation of self-efficacy. Critical thinking can promote the formation of self-efficacy because it can promote individuals to analyze and judge their own abilities. Therefore, individuals with strong critical thinking can face all kinds of problems in work more confidently and cope with the dynamic changing environment. Face and other studies found that critical thinking helps to strengthen employees' ability to identify problems, encourage employees to face challenges and setbacks, and strengthen employees' belief in completing tasks (face 2011). Jiang and Yang (2016) also proved that critical thinking can significantly promote self-efficacy through empirical research. These empirical results lay a foundation for the verification of the impact of critical thinking on self-efficacy. Therefore, this study proposes the following hypothesis:

H2 critical thinking has a positive impact on self-efficacy.

Students with strong self-efficacy can produce new ideas and creativity through their own efforts. At the same time, students with critical thinking can improve their self-efficacy through reflection and judgment, which will help students improve their confidence in creativity. When the self-efficacy of postgraduates is improved, it can further have a positive impact on their scientific research creativity. According to the basic view of social cognitive theory, individual self-efficacy is the key factor to determine individual decision-making and behavior (Bandura, 1977). The research of Zhang shows that the research self-efficacy of postgraduates is negatively correlated with academic misconduct (Zhang et al, 2013).

Therefore, individuals with strong self-efficacy are willing to invest in critical thinking activities; while individuals with low self-efficacy tend to invest less in critical thinking due to their lack of confidence in themselves. Can we say that self-efficacy will play an intermediary role in the relationship between critical thinking and creativity? Therefore, this study proposes the following hypothesis:

H3 self-efficacy has a positive impact on graduate students' creativity.

Karwowski and Lebuda (2017) have shown that self-identity partially regulates the relationship between open thinking and creative activity. Chen (2016) shows that self-efficacy plays an intermediary role in the relationship between self-identity and creative behavior. Qiang studied the influence of critical thinking on the creativity of senior high school students through the intermediary of self-efficacy (Qiang, R. 2018). Therefore, self-identity can be transformed into higher participation and creative task efforts, and mediation mechanisms will indeed emerge. Can we think that the higher the self-identity is, the more likely it is that its creative potential will be transformed into activities and behaviors. In the relationship between critical thinking and creativity, will this pattern also be replicated? Therefore, the following hypothesis is put forward:

H4 critical thinking affects graduate students' creativity through self-efficacy.

### **Design of the study**

The experimental design of this study is based on graduate students from a university in Shaanxi Province, China. The scale used in the experiment should cover three dimensions: critical thinking, self-efficacy and creativity. Among them, the scale developed by Ye Yuzhu (1999), a Taiwanese scholar, is used for critical thinking, which includes four dimensions: systematic and analytical ability, open mind, intellectual curiosity, overall and introspection, with 20 items in total. General self-efficacy scale (GSEs) was used to measure self-efficacy. The first German version was compiled by Professor Schwarzer, a psychologist at Berlin Free University in 1981, with 10 items in total. Creativity uses the scale compiled by Zhou and George (2001), which has 13 items in total. In recent years, the scale has been widely concerned by scholars at home and abroad, and has good application effect in the empirical study. At the same time, the above three scales all meet the standards of academic research reliability and validity.

### **Method**

According to the above research hypotheses and the logical thinking of experimental design, the research methods and framework to be implemented are listed as follows:

#### ***research samples***

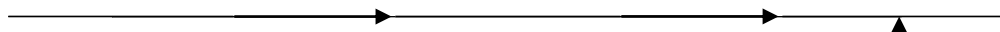
In this study, a university graduate student in Shaanxi Province of China was chosen as the research object, and the questionnaire was distributed by convenient sampling. A total of 150 questionnaires were sent out, 132 of which were recovered (recovery rate 88.0%), 126 of which were valid after the incomplete invalid questionnaires were eliminated. The basic characteristics of effective survey sample: 27 males, accounting for 21.4%; 99 females, accounting for 78.6%. 81 people aged 24 and under accounted for 64.3%, and 45 people aged 25-30 accounted for 35.7%. 84 in the first grade, accounting for 66.7%, 36 in the second grade,

accounting for 28.6%, and 6 in the third grade, accounting for 4.8%. Science and engineering 45 people, accounting for 35.7%, humanities and Social Sciences 81 people, accounting for 64.3%.

### *research methods and framework*

This study adopts the following three methods: (1) literature research. Literature research method refers to the comprehensive and accurate understanding of the essential attributes of things by reading relevant materials according to the problems to be studied and the needs of specific research purposes or themes. On the basis of critical thinking, self-efficacy and creativity, this paper establishes the research direction and research model. (2) Questionnaire survey. In this study, data were collected mainly through questionnaires. The questionnaire is a form used for statistics and investigation to verify the research questions raised. (3) Data analysis. In this study, spss24.0 was used for statistical analysis. Specifically, spss24.0 is used for descriptive statistical analysis, correlation analysis, reliability test and common method variation test; multiple regression statistical analysis is used to test the relationship between critical thinking, self-efficacy and creativity.

By combing the relationship among critical thinking, self-efficacy and creativity, the following research models are proposed as the research framework of this study, as shown in Figure 1.



**Figure 1 Research framework**

### **DATA ANALYSIS**

According to the above research hypotheses, experimental design, research methods and framework, statistical analysis was carried out by using spss24.0. The data of questionnaire and statistical results were analyzed as follows:

#### **The results of Reliability, Validity and Correlation analysis**

In this study, 43 items of the questionnaire were analyzed for reliability. The results showed that the internal consistency coefficient of Cronbach's alpha was. 931, which was acceptable. The reliability test results of each subscale are as follows:

Reliability analysis was conducted on 20 items of critical thinking scale. The results showed that the internal consistency coefficient of Cronbach's alpha was. 843, which was acceptable. Reliability analysis was conducted on 10 items of general self-efficacy scale, and the results showed that Cronbach's was acceptable The internal consistency coefficient of alpha is. 877, which has an acceptable reliability. The reliability analysis of 13 items in the table of creative power shows that the internal consistency coefficient of Cronbach's alpha is. 898, which has an acceptable reliability. See Table 1 for details.

**Table 1 The results of Reliability and Validity**

variab- -le	Item	Fact- or load	Cronbach’s alpha	Cumul- ative KMO	Varian- ces (%)	Variable Item	Factor load	Cronbach’s alpha	KMO	Cumul- ative Varianc- -es (%)	
<b>Criti- -cal thin -king</b>	A1	0.51	0.84	0.52	76.06	B1	0.89	0.87	0.80	74.52	
	A2	0.47				B2	0.66				
	A3	0.53				B3	0.74				
	A4	0.51				B4	0.76				
	A5	0.58				<b>self-effi- cac</b>	B5				0.53
	A6	0.90				B6	0.78				
	A7	0.63				B7	0.62				
	A8	0.57				B8	0.94				
	A9	0.55				B9	0.86				
	A10	0.50				B10	0.58				
	A11	0.53	C1	0.53							
	A12	0.74	C2	0.88							
	A13	0.56	C3	0.62							
	A14	0.46	C4	0.60							
	A15	0.43	C5	0.53							
	A16	0.47	C6	0.50							
	A17	0.50	<b>creativi- -ty</b>	C7	0.85	0.89	0.79	72.12			
	A18	0.46	C8	0.75							
	A19	0.55	C9	0.48							
	A20	0.59	C10	0.97							
		C11	0.74								
		C12	0.73								
		C13	0.69								

Spss24.0 was used to test the validity of the questionnaire. Table 1 shows that the kmo values of critical thinking, self-efficacy and creativity are 0.52, 0.80 and 0.79, respectively, which are greater than 0.5, and the percentage of cumulative explanatory variance is greater than 70%. The two data sizes are in line with the criteria of dzubian & shirkey, 1974), which shows that the questionnaire conforms to the internal logical relationship of the data, the validity of the questionnaire structure is good, and the correlation analysis can be carried out.

The results of Pearson correlation analysis using spss24.0 are shown in Table 2. The results showed that critical thinking [R (126) = . 54, P <. 001], self-efficacy [R (126) = . 70, P

<. 001] were positively correlated with creativity. There was a significant positive correlation between critical thinking [R (126) = .53, P <. 001] and self-efficacy.

**Table 2 Correlation matrix between critical thinking and creativity (N=126)**

	1	2	3
<b>1. Critical Thinking</b>	-		
<b>2. Self-efficacy</b>	.53***	-	
<b>3. Creativity</b>	.54***	.70***	-

\*\*\*  $p < .001$

**The results of Regression analysis**

Regression analysis was used to test the media Ting effect of self-efficacy on critical thinking and creativity. The results are shown in Table 3. The results show that critical thinking has significant explanatory power to self-efficacy ( $\beta = .53, P < .001$ ), research hypothesis H1 is tenable; critical thinking has significant explanatory power to creativity ( $\beta = .54, P < .001$ ), research hypothesis H2 is tenable; self-efficacy has significant explanatory power to active innovation behavior ( $\beta = .70, P < .001$ ), the research hypothesis H3 holds; when considering the explanatory power of critical thinking and self-efficacy to creativity, the explanatory power of critical thinking is significant ( $\beta = .23, P < .01$ ), and the explanatory power of self-efficacy is significant ( $\beta = .58, P < .001$ ). According to the judgment of Baron and Kenny (1986), the mediation effect is tenable, and the part of self-efficacy mediates critical thinking and creativity. The research hypothesis H4 is tenable.

**Table3 Regression analysis of intermediary effect of critical thinking, self-efficacy and creativity**

	Self-efficacy		Creativity	
	Model 1	Model 2	Model 3	Model 4
<b>Critical Thinking</b>	.53***	.54***		.23**
<b>Self-efficacy</b>			.70***	.58***
$R^2$	.28	.29	.50	.54
$Adj R^2$	.27	.28	.49	.53
$F$	48.33***	51.75***	124.56***	72.26***
Freedom	(1,124)	(1,124)	(1,124)	(1,124)

Note: the values in the table are standardized regression coefficients ( $\beta$ ) \*  $p < .05$  \*\*  $p < .01$  \*\*\*  $p < .001$

**CONCLUSION AND DISCUSSION**

Summarize the above data analysis, discuss the conclusions and results, and make suggestions for the follow-up related research, as follows:



## **Conclusion**

Based on the theory of social cognition, this study, from the perspective of individual psychology and cognition, explores the influence mechanism of critical thinking on graduate students' creativity, and finds some mediating effects of self-efficacy. Combined with the results of data statistical analysis, the specific conclusions of this study are as follows:

The relationship between critical thinking and self-efficacy of postgraduates is positive correlation, that is, critical thinking is positive to promote the creativity of postgraduates. By improving the critical thinking of postgraduates, the self-efficacy of Postgraduates can be improved.

There is a positive correlation between critical thinking and graduate students' creativity, that is, critical thinking will positively promote teachers' autonomous motivation. The creativity of graduate students can be improved by improving their critical thinking.

The relationship between self-efficacy and graduate students' creativity is positive correlation, that is, self-efficacy is positively promoting graduate students' creativity. The creativity of graduate students can be improved by improving their self-efficacy.

Self-efficacy mediates critical thinking to promote graduate students' creativity, which has an incomplete mediating effect. That is to say, when self-efficacy is the mediating variable to explore critical thinking and graduate students' creativity, there is a significant causal relationship between critical thinking and graduate students' creativity. The creativity of graduate students can be improved by improving their critical thinking and self-efficacy.

## **Discussion and Suggestions**

As this study mainly explores the influence of critical thinking on the creativity of Chinese graduate students, and produces some similarities and differences with previous studies in theory and practice, it has made certain academic contributions to this research topic, as well as the research discussion and suggestions, which are listed as follows:

### ***Academic contribution***

This study found that the mechanism of critical thinking on graduate students' creativity is consistent with the research. From the perspective of individual cognition, this paper takes self-efficacy as an intermediary. The results show that critical thinking has a positive impact on graduate students' creativity, and self-efficacy plays a part of the intermediary role. This conclusion expands the research of critical thinking in the field of pedagogy, and provides a new perspective to explore how individual characteristics and psychology affect creativity from the graduate level.

Based on the previous research results, this paper finds that the research object of creativity is mainly from the first celebrities to the present employees and primary and secondary school students. This paper takes graduate students as the research object to expand the research field of creativity. As the highest level of education, postgraduates have higher and higher requirements for creativity, so we should strengthen the research on Postgraduates in the research of creativity.

### ***Physical contribution of Education Management***

This study found that critical thinking has a significant positive role in promoting the creativity of graduate students, so we should pay attention to improving their critical thinking in the process of graduate training. As a positive way of thinking, critical thinking can only help postgraduates master the relationship between critical thinking and creativity, and gradually improve the critical thinking of Postgraduates by means of curriculum, practice and second class, so as to lay a solid foundation for improving the creativity of postgraduates.

This study found that self-efficacy has a significant positive role in promoting graduate students' creativity, and can positively regulate the relationship between critical thinking and creativity. The conclusion of this study provides a new way for the realization of the goal of graduate education in China.

### ***Deficiencies and Follow research***

This study also has the following limitations: ① all the research materials in this paper are obtained from one school, which may lead to the problem of homologous deviation. Although some measures have been taken to prevent it, it will still have an impact on the research results. ② In this paper, the cross-sectional research method is adopted, and the follow-up research can adopt the longitudinal or experimental research method, which should be able to enhance the persuasiveness of the causal relationship between the relevant variables. ③ Most of postgraduates who enter the work unit after graduation are "potential employees" in the future. In the follow-up research, we should compare the promotion of employee creativity with that of postgraduates. ④ The research samples are concentrated in Shaanxi Province, and further research can be considered to further verify the research conclusions through a broader regional sampling.

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