Research on the Impact of Psychological Capital of Applied University Teachers on Innovation ability—Based on regression models

Yanqi Bai, Weiwei Wu*

Anhui Xinhua University, Hefei, China

baiyanqi@axhu.edu.cn,*wuweiwei@axhu.edu.cn

Abstract. This article takes applied university teachers as the research object. From the perspective of psychological capital to studies the innovative ability of college teachers. Multivariate statistical methods are used to explore psychology based on the four elements of psychological capital: confidence, optimism, resilience and hope. Studies have shown that the innovation ability of teachers of undergraduate universities is significantly related to psychological capital, and independent variable psychological capital has a significant positive predictive effect on variable innovation capabilities. Psychological contract and innovative mind play an important mediating role in the impact of psychological capital on innovation ability.

Keywords: Psychological capital; Application; Innovation ability; teacher.

1 Introduction

Top innovative talents are an important driving force for strengthening national strategic scientific and technological strength and improving overall innovation level. As an important base for cultivating talents, developing technology, and serving society, universities play a crucial role in promoting national innovation and development. The innovation ability of university teachers is directly related to the innovation awareness and ability of students, and is related to the level of cultivating innovative talents in universities. Application-oriented undergraduate universities bear the important mission of serving local economic and social development and cultivating high-level application-oriented talents. Teachers must focus on seeking novelty and difference in teaching reform, applied research and social services. Only by having the ability to discover and solve new problems can we better cultivate applied innovative talents. Psychological capital is a positive psychological quality and mental state of an individual. Psychological capital will to some extent affect the development of innovation ability. Therefore, universities should actively develop teachers' psychological capital and create good conditions to improve teachers' innovation ability. The study of the impact mechanism of psychological capital on innovation ability can help universities

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propose strategies to enhance innovation ability from the perspective of psychological capital.

2 Definition of Relevant Concepts

2.1 Psychological Capital

Psychological capital was first proposed by renowned American scholars Goldsmith, Darity, and Veum in 1997. They believed that psychological capital refers to personality traits that can affect an individual's productivity. These traits reflect a person's self view or self-esteem, dominate a person's motivation and general attitude towards work. [1][9] Luthans et al. (2005) first defined psychological capital as "the core psychological element of an individual's general positivity, specifically manifested as a psychological state that meets the standards of positive organizational behavior. It goes beyond human capital and social capital, and can enable individuals to gain competitive advantages through targeted investment and development."[2] Luthans, Youssef, and Avolio (2007) revised the definition of psychological capital, stating that it refers to "a positive psychological state exhibited by an individual in the process of growth and development, characterized by self-efficacy, optimism, hope, and resilience.". Self efficacy refers to having confidence and the ability to make necessary efforts to achieve success in challenging work; Optimism, which means having a positive attribution to current and future success; Hope is perseverance towards goals, and the ability to adjust the path to achieving them when necessary to achieve success; Resilience refers to the ability to persevere, quickly recover, and surpass in times of adversity and problems, in order to achieve success. [3]-[6]This article draws on and adopts this viewpoint.

2.2 Innovation Ability

The term innovation was first proposed by the renowned American economist Joseph Alois Schumpeter in his book "Economic Development Theory" published in 1912. Its connotation is the process of creating new value by combining an unprecedented factor of production and production conditions.[10] The commonly accepted view in China regarding innovation ability is the ability of humans to creatively discover, propose, analyze, and solve problems. It is the ability of humans to apply knowledge and theory to continuously provide new ideas, theories, methods, and inventions with social, economic, and ecological value in science, technology, art, and various practical activities. It is a comprehensive ability that includes human cognitive and practical abilities. Applied undergraduate universities aim to cultivate applied talents, and the innovation ability of teachers mainly refers to their ability to seek differences and novelty in teaching reform, practical teaching, applied research, and social services. They discover, propose, and solve new problems for local economic and social development, and creatively carry out teaching and research work. [11] [12]

3 Empirical Research Design

3.1 Research Hypothesis

Based on the literature review and practical needs, this article uses empirical analysis to study the direct impact mechanism of each dimension of psychological capital on teachers' innovative ability. To this end, the following research hypotheses are proposed:

H1: Psychological capital has a significant impact on the teaching reform of college teachers;

H2: Psychological capital has a significant impact on the innovative consciousness of college teachers;

H3: Psychological capital has a significant impact on the innovation ability of college teachers;

H4: Self-confidence has a significant positive impact on the innovation ability of college teachers;

H5: Hope has a significant positive impact on the innovation ability of college teachers;

H6: Optimism has a significant positive impact on the innovation ability of college teachers;

H7: Resilience has a significant positive impact on the innovation ability of college teachers.

H8: Psychological contracts have a significant mediating effect on the impact of psychological capital on innovation ability.

H9: Innovative mind has a significant mediating effect on the impact of psychological capital on innovation ability.

3.2 Questionnaire Design

The questionnaire mainly contains three parts: The first part is demographic variable information, and the questions cover all explanatory variables, including gender, age, marital status, education, length of service, professional title, overseas study or scientific research experience. The second part is the psychological capital scale, which includes 12 questions selected from the PCQ-24 scale and contains four dimensions (optimism, hope, confidence, and resilience). Innovation ability includes 10 questions on teaching reform, innovation awareness, innovation results and school support. Questions on psychological capital and innovative ability are all scored using a 5-point Liken scale (1 = "strongly disagree", 5 = "strongly agree"). The psychological capital score is the arithmetic mean of the scores of each dimension, and the innovation ability score is the arithmetic mean of the scores of each factor.[7][8]

3.3 Reliability and Validity Test

Firstly, a small- scale predictions was made on the initial scale, and the reliability analysis and validity test of the questionnaire were conducted.

Cronbach's coefficient is a commonly used reliability coefficient in reliability testing. In the table 1 reliability statistical scale, Cronbach's Alpha coefficient is 0.811, which is between 0.8-0.9, indicating that the reliability of this questionnaire is very good. It is possible to carry out the following analyses. KMO is one of the validity test indicators. As shown in table 2, the value of KMO is 0.689, between 0.6 and 0.7, indicating that the validity is good and this questionnaire is meaningful.

Table 1. Reliability statistics

Cronbach's Alpha	Cronbachs Alpha based on standardized terms	Number of items
.811	.904	33

Table 2. KMO and Bartlett's test

Olkin metric of sampling sufficiency		.689
Bartlett's test of sphericity	Approximate chi-square	565.142
	df	78
	Sig.	.000

3.4 Analysis of the Impact of Psychological Capital Factors on Innovation Ability

3.4.1 Correlation Analysis

Through correlation analysis, the Pearson correlation coefficient r was used to examine the degree of correlation between various factors of psychological capital and innovation ability.

Table 3. Correlation analysis (Pearson correlation)

	1	2	3	4	5	6	7	8	9
1 Confidence	1								
2 Hope	.746**	1							
3 Toughness	.616**	.824**	1						
4 Optimism	.616**	.710**	.718**	1					
5 Psychological capital	.843**	.928**	.895**	.864**	1				
6 Teaching reform	.578**	.627**	.591**	.484**	.646**	1			
7 Innovative mind	.615**	.562**	.582**	.582**	.663**	.667**	1		
8 Innovation achievements	.553**	.512**	.532**	.581**	.617**	.599**	.732**	1	
9 Innovation ability	.676**	.662**	.639**	.625**	.783**	.836**	.900**	.905**	1

It can be seen from table 3 that the correlation coefficient between the self- confidence dimension of psychological capital and innovation ability is r=0.676, and the correlation test is significant at 0.01, so there is a significant positive correlation; the hope, toughness and optimism dimensions and innovation ability The correlation coefficients are 0.662, 0.639, and 0.625 respectively, and the correlation tests are all significant at 0.01, so they are all significantly positive correlations. The correlation

coefficient between psychological capital and innovation ability is 0.783, and the correlation test is significant at 0.01, showing a strong positive correlation. The correlation coefficients between psychological capital and teaching reform, innovative consciousness, and innovative achievements are 0.646, 0.663, and 0.617, respectively. The correlation test is significant at the 0.01 level, so there is a significant positive correlation between psychological capital and teaching reform, innovative consciousness, and innovative achievements.

3.4.2 Univariate Regression Analysis

Taking the innovation ability of college teachers as the dependent variable and psychological capital as the independent variable, a single regression analysis was performed. Table 4 shows that the coefficient of determination R value is 0.724, which means the regression model has a good effect; R square is greater than 0.4, and the goodness of fit is good. better.

Table 4. Model summary

Model	R	R Square	Adjust R Square	Standard Error of Estimate
1	.724	.525	.521	.33095

From the coefficient table in table 5, the sample regression equation can be obtained as: Innovation ability= 0.514 + 0.682 * Psychological capital. This shows that innovation ability is affected by psychological capital and has a significant positive predictive effect.

Table 5. Coefficient table

Model		Unstandardized coefficient		Standard coefficient	*t*	*Sig.*
		B	SE	Trial version		
1	(constant)	.514	.125		4.100	.000
	psychological capital	.682	.059	.724	11.462	.000

3.4.3 Multiple Regression Analysis

Taking the innovative ability of college teachers as the dependent variable and the factors of psychological capital as independent variables, a multiple regression analysis was conducted. In table 6, the R-square is 0.539, indicating good goodness of fit of the model.

Table 6. Model summary

Model	R	R Square	Adjust R Square	Standard Error of Estimate
1	.734[a]	.539	.523	.33007
2	.734[b]	.539	.527	.32867

Table 7 is used to test whether the two fitted models are statistically significant overall. The Sig value corresponding to the F value is much less than 0.05. The result

indicates that the two models have certain predictive value. At the 95% significance level, the regression equation can be used. According to table 8, The hoped-for P value in the first model is 0.928, which is greater than 0.05, and the independent variable hoped should be eliminated. There is little change in the regression coefficient estimates for confidence, resilience, and optimism from the second model, providing indirect support that hope should be eliminated. The regression model is:

Innovation ability=0.49+0.301*confidence+0.216*resilience+0.174*optimism. This indicates that confidence, resilience, and optimism have a positive predictive effect on innovation ability.

Table 7. Variance analysis table

Model		Sum of Square	*df*	Mean Square	*F*	*Sig.*
1	return	14.785	6	3.696	33.927	.000[b]
	residual	12.638	211	.109		
	total	27.423	217			
2	return	14.784	7	4.928	45.620	.000[c]
	residual	12.639	210	.108		
	total	27.423	217			

Table 8. coefficient table

Model		Unstandardized Coefficient		Standard Coefficient	t	Sig.
		B	SE	trial version		
1	(constant)	.490	.126		3.899	.000
	confidence	.305	.080	.366	3.797	.000
	hope	-.010	.114	-.012	-.090	.928
	toughness	.221	.097	.269	2.282	.024
	optimism	.176	.079	.215	2.219	.028
2	(constant)	.490	.125		3.915	.000
	confidence	.301	.070	.362	4.310	.000
	toughness	.216	.078	.263	2.768	.007
	optimism	.174	.078	.213	2.244	.027

3.5 Regression Analysis of the Impact Mechanism of Psychological Capital on Innovation Ability

Further explore the impact mechanism of psychological capital on innovation ability, and based on the data analysis of the survey results, we further propose the following hypothesis: Psychological contract plays a mediating role in the impact of psychological capital on innovation ability. Psychological capital affects innovation ability through its impact on teachers' job satisfaction and innovation awareness.

Table 9. Variable correlation analysis

Factor	1	2	3	4	5
psychological capital	1				
Job Satisfaction	0.095	1			
psychological contract	0.453**	0.115	1		
Innovative mind	0.662**	-0.038	0.363**	1	
Innovation ability	0.783**	-0.043	0.424**	0.832**	1

It can be concluded from table 9 that there is a significant correlation between psychological contract, psychological capital, innovation awareness and innovation ability. However, the correlation between job satisfaction and psychological capital and innovation ability is not significant. Therefore, this study hypothesizes that psychological contract and innovation consciousness have a mediating effect on the impact of psychological capital and innovation ability. Based on this assumption, construct a structural equation model as shown in (1)-(3).

$$Y=e+cX \tag{1}$$

$$Z1=ei+aiXi \tag{2}$$

$$Yi= ciX+biM+ej \tag{3}$$

Table 10. Mediation model analysis of psychological contract

Regression Equation		Overall fit index		RC significance			Bootstrap	
Outcome variable	Predictor variable	R^2	F	β	SE	Sig	lower limit	Upper limit
Innovation ability	Psychological capital	0.614	76.235	0.783	0.089	0.001	0.559	0.918
Psychological contract	Psychological capital	0.205	12.386	0.453	0.262	0.001	0.396	1.461
Innovation ability	Psychological capital	0.620	38.299	0.744	0.099	0.000	0.536	0.936
	Psychological contract			0.088	0.042	0.390	-0.048	0.118

The data in table 10 shows that, first of all, the total effect is significant, that is, psychological capital can independently and significantly predict the innovation ability

of college teachers (c=0.783, p<0.001). Secondly, using psychological capital as an independent variable can significantly and positively predict psychological contract (a_1=0.453, p<0.001). Under the joint action of psychological capital and psychological contract, psychological capital can significantly and positively predict teachers' innovation ability (c_1'=0.744, p<0.001), but the psychological contract prediction is not significant (b_1=0.088, p>0.001). Further Sobe testing is required, Firstly, we test the product a*b of the regression coefficients. According to the data in Table 10, a_1b_1= 0.453*0.088=0.0399≠0, the test result is significant, and then the test statistic is tested. The formula is as follows:

$$Z=ab/Sab \tag{4}$$

$$S_{ab}=\sqrt{a^2s_b{}^2+b^2s_a{}^2} \tag{5}$$

According to formula (4) (5), it can be concluded that Z= ab/Sab = $0.453*0.088/\sqrt{0.453^2*0.041^2+0.088^2*0.089^2}$=1.9777, P=0.028 p<0.001, indicating that the result is significant, so the mediating effect of psychological contract between psychological capital and innovation ability is significant. The mediating effect value is a_1b_1=0.453*0.088=0.0399. The ratio to the total effect is: Effect m=a_1b_1/c=0.0399/0.783=0.0510. The mediating effect explains the variance of the dependent variable as Sqrt (0.620-0.614) =0.0775.

Table 11. Mediation model analysis of innovation awareness

Outcome variable	Predictor variable	R	R^2	F	β	SE	Sig	Lower limit	Upper limit
Innovative mind	Psychological capital	0.662	0.439	37.510	0.662		0.000	0.502	0.958
Innovation ability	Psychological capital	0.888	0.789	87.661	0.414	0.121	0.000	0.196	0.664
	Innovative mind				0.558	0.114	0.000	0.253	0.663
Innovation ability	Psychological contract	0.889	0.790	57.716	0.044	0.035	0.569	-0.064	0.098
	Innovative mind				0.553	0.078	0.000	0.158	0.645
	Psychological capital				0.397	0.091	0.000	0.230	0.682

The data in table 11 shows that psychological capital as an independent variable can significantly and positively predict innovation awareness (a_2=0.662, p<0.001). Under

the joint action of psychological capital and innovation awareness, psychological capital can significantly and positively predict teachers' innovation. ability (c_2'=0.414,p<0.001), innovation consciousness can significantly positively predict teachers' innovation ability (b_2=0.558, p<0.001), so innovation consciousness is the mediator between psychological capital and innovation ability The effect is significant. The mediation effect value a_2b_2=0.662*0.558=0.3694, and the ratio to the total effect is: Effect m=a_2b_2/c= 0.3694 /0.783=0.4718. The mediation effect explains the variance variation of the dependent variable as Sqrt (0.789-0.614) =0.4183.

4 Conclusions

The innovation ability of applied undergraduate university teachers is significantly positively correlated with psychological capital, and the independent variable psychological capital has a significant positive predictive effect on the dependent variable innovation ability, among the four elements of psychological capital, self-confidence has the greatest correlation with innovation ability, and has a positive prediction effect on innovation ability; resilience and optimism have a greater correlation with innovation ability, and has a positive prediction effect on innovation ability. The correlation between hope and innovation ability is small, and the predictive effect on innovation ability is not significant. Psychological contract and innovation consciousness have a significant mediating effect on the impact of psychological capital on innovation ability.

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