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Research on the Relationship between Psychological Capital and Innovation Ability of Independent College Students: Empirical Research Based on 871 Samples

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Abstract: This study selected independent college students as research subjects and used a questionnaire survey method to collect 871 valid samples. Through the analysis of differences, it was concluded that male students have significantly higher levels of task-oriented psychological capital and innovation ability than female students. There are significant differences in task-oriented psychological capital among college students of different grades, but no significant difference in personal-oriented psychological capital and innovation ability. Through relevant analysis, it was concluded that personal-oriented psychological and its dimensions, as well as task-oriented psychological capital and its dimensions, and innovation ability and its dimensions among college students are significantly positively correlated with each other. Through the structural equation model, it was concluded that personal-oriented psychological capital and task-oriented psychological capital have a significant positive impact on the innovation ability of college students. Based on the above conclusions, countermeasures to enhance the innovation ability of college students are proposed.

Keywords: Independent college students; Personal-oriented psychological capital; Task-oriented psychological capital; Innovation ability

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1. Introduction

In recent years, along with the development of the economy and society, and changes in the living environment and employment environment, the psychological problems of college students have become more and more prominent under the influence of various anxieties, such as adaptation to schooling, academic and employment pressures, and this phenomenon has increasingly received widespread attention from the whole society. Facing the changes of the social and economic environment, college students need to do a good job of psychological

adjustment, and constantly improve the level of psychological capital, to promote the positive development of physical and mental health, and better adapted to the university life, on the other hand, before entering the society, college students also need to comprehensively improve their self-competitiveness, especially the core competitiveness of the development of the individual — innovation ability. In the era of rapid development of economy and technology, innovation ability can not only promote the overall improvement of personal ability, but also be one of the important factors for the survival and development of the organization, which helps to accelerate the transformation of scientific and technological achievements, and promote the survival and development of the organization. For enterprises, they are more inclined to recruit university graduates with good psychological quality and strong innovation ability. Therefore, this study selects the perspective of psychological capital to explore the path of college students' innovation ability.

Scholars generally believe that innovation ability can be analyzed, explained, and cultivated [1]. The process of innovation is the process of groundbreaking knowledge restructuring and updating, and organizations or individuals inevitably face all kinds of pressures and psychological burdens in the process of innovation, and even consume psychological resources. It is very difficult to carry out innovation activities efficiently if they cannot regulate their own psychological state in a timely manner. Therefore, it is of great significance for individuals and enterprises to maintain a positive and optimistic mindset and keep the level of their psychological capital at a high level. In recent years, academic research on psychological capital and innovation performance has become more and more in-depth, and the research object generally focuses on enterprise employees, especially employees of high-tech enterprises and knowledge-based enterprises, and it is generally believed that the level of psychological capital is positively correlated with the innovation performance, and various measures to improve the innovation performance of employees are proposed from the perspective of constructing positive psychological capital. The research on the relationship between psychological capital and innovation ability of college students has yet to be further enriched, while colleges and universities, as the main position for sending talents to enterprises, how to cultivate college students with high level of psychological capital and strong innovation ability has increasingly become one of the important goals to measure the level of talent cultivation in colleges and universities.

2. Theoretical foundations and research hypotheses

2.1. Psychological capital

In the process of capital evolution to gain competitive advantage, psychological capital appears after economic capital, human capital, and social capital, which is a stable and existent intrinsic trait containing effective emotional communication, self-monitoring, and cognitive ability, as well as a positive psychological state that motivates individuals to work more efficiently and happily, promotes career success, and balance life better [2–4]. In addition, Avolio et al. proposed that psychological capital can be developed through a series of external ways and means. With the deepening of research, the development and measurement of psychological capital in the academic world has been deepened, and the measurement and division of elements of psychological capital at home and abroad have become increasingly rich. Foreign researchers have successively developed the Core Self-Esteem Conceptual Scale, which contains the dimensions of self-esteem, self-efficacy, control point, and emotional stability. The Big Five Personality Scale, which covers emotional stability, extraversion, openness, agreeableness, and responsibility, and the Psychological Capital Status Scale, which covers the dimensions of hope, optimism, resilience, and self-efficacy. Domestic researchers have also developed a second-order eight-

dimensional local psychological capital scale that includes task-oriented and personal-oriented psychological capital through their own research. The Chinese employee psychological capital scale with structural elements of calmness, hope, optimism, and confidence, the Knowledge-based employee psychological capital scale, which includes dimensions of task-based, relationship-based, learning-based, and innovation-based psychological capital, the psychological capital scale for college students, consisting of nine elements of optimism, confidence, gratitude, tolerance, progress, resilience, responsibility, integrity, and hope, and so on. Considering the differences between Chinese and Western cultures, the native psychological capital scale developed by Ke Jianglin and Sun Jianmin will be selected for this study. The dimensions of task-oriented psychological capital in the native scale have great similarities with those of the Western psychological capital scale, while the personal-oriented psychological capital part highlights the Chinese cultural characteristics, and this study will further enrich the mechanism of personal-oriented psychological capital that differs from Western culture.

2.2. Innovation ability of college students

At present, there is no uniform standard for the definition and measurement dimension of college students' innovation ability. The measurement of innovation capability or innovation performance can generally be divided into enterprise-level and individual-level; this study mainly focuses on the individual level. The existing studies on the innovation ability of college students cover different dimensions. Liu Hongguang divided college students' innovation ability into four dimensions of innovation consciousness, innovative thinking, innovative personality, and innovative skills [5]. Li Ning and Wang Ning proposed the "dual" conceptual framework of college students' innovation ability, which includes innovative thinking and innovative personality [1]. Guo Jianru and Deng Feng also constructed the output index of college students' innovative ability from two aspects of innovative thinking and innovative personality [6]. Meng Jun and Bai Yuying divided the evaluation indicators of college students' innovation ability into innovative learning ability, innovative knowledge foundation, innovative thinking ability, and innovative practical operation ability [7]. Hang Zusheng constructed an evaluation index system of college students' innovation ability based on the background of industry-university-research cooperation, which contains innovation knowledge accumulation, innovation thinking, innovation skills, innovation personality and team, innovation environment, and innovation results [8]. Wang Junnan and Zheng Bowen constructed an evaluation index for college students' innovation ability based on systematic thinking, which includes learning, knowledge application, practical skills, team division of labor, and cooperation skills [9]. Zhao Wuyi divided the evaluation index system of college students' innovation ability into four parts: learning ability, knowledge level, thinking ability, and innovative practice. Zhao Wuyi divided the evaluation index system of college students' innovation ability into four parts as follows: learning ability, knowledge level, thinking ability, and innovation practice [10]. Yang Dong summarized the measurement indicators of innovation and entrepreneurship ability of college students into practice dimension, creativity dimension, leadership dimension, and learning dimension [11].

2.3. The relationship between psychological capital and the innovation ability of college students

Research on the dimensions and elements of psychological capital, both domestically and internationally, has shown positive effects. Luis Salazar and Beatrice Avolio found that psychological capital has a positive effect on innovation ability based on the empirical study of banking institutions [12]. Blasco-Giner found that psychological capital helps to activate innovative behavior [13]. Shives N found that positive psychological

capital increases academic success [14]. He Xingzhou found that the development of psychological capital helps to enhance the innovation potential of college students, and proposed a series of cultivation measures in higher education to develop the psychological capital of college students [1]. Yuanrui, Huang Shihua et al. found that psychological capital can not only directly affect college students' innovative behavior, but also influence their innovative behavior through the motivation to challenge difficulties or personal interests [15]. It can be seen that for the college student group, a positive state helps to strengthen the communication and collaboration with classmates, which in turn improves the individual's innovation ability. It has been demonstrated that psychological capital and its related dimensions, such as self-efficacy, hope, optimism, resilience, drive, optimism, self-confidence and bravery, tolerance and forgiveness, modesty and sincerity, gratitude and dedication, are significantly positively correlated with innovative behaviors. For college students, task-oriented psychological capital shows a positive and enterprising side, which is conducive to them better exerting their own advantages, overcoming difficulties in academic competitions and research, and constantly generating new ideas. While personal-oriented psychological capital is conducive to college students better accommodating and integrating into their classmates around them, especially team members participating in academic research and competitions together, which contributes to the effect of the team and promotes the transformation of innovation achievements. Therefore, this study makes the hypotheses, H1: Personal-oriented psychological capital is significantly positive related to college students' innovation ability; H1a: The dimensions of personal-oriented psychological capital are significantly positive related to the dimensions of innovation ability; H2: Task-oriented psychological capital is significantly positive related to college students' innovation ability; H2a: The dimensions of task-oriented psychological capital are significantly positive related to the dimensions of college students' innovation ability. H3: Personal-oriented psychological capital has a significant positive effect on college students' innovation ability. H4: Task-oriented psychological capital has a significant positive effect on college students' innovation ability.

3. Hypothesis testing and model validation

3.1. Measurement tools and reliability test

In this study, students in the author's independent college were selected for questionnaire research, and a total of 923 questionnaires were collected. After deleting invalid and duplicate questionnaires, there are a total of 871 valid questionnaires. SPSS 26.0 was used to conduct reliability tests, independent samples t-test, one-way ANOVA, and correlation analysis, and AMOS26.0 was used for validating the structural equation model and path analysis.

The study adopted the indigenous two-factor psychological capital scale developed by Ke Jianglin et al. The Cronbach's alpha value of task-oriented psychological capital is 0.953. The alpha values of the four dimensions of spirit of enterprise and diligence, resiliency and perseverance, optimism and hope, self-confidence and courage are 0.904, 0.906, 0.889, and 0.894. The Cronbach's alpha value of personal-oriented psychological capital is 0.955. The alpha values of the four dimensions of toleration and forgiveness, modesty and prudence, gratitude and dedication. respecting and courtesy are 0.88, 0.843, 0.891, and 0.892.

The questionnaire of college students' innovation ability adopts a self-developed two-dimensional scale. The Cronbach's alpha value of college students' innovation ability is 0.889, and the alpha values of the two dimensions of independent learning, innovative thinking, and practical ability are 0.917 and 0.889.

3.2. Common method bias test

The Harman single-factor analysis method was used to test the common method bias of the collected data. The first common factor explained 34.546% (<40%) of the total variance. Therefore, there is no serious common method bias in the study [16].

3.3. Difference analysis and correlation analysis of variables

An independent sample t-test was conducted on the gender differences in psychological capital and innovation ability of college students. The results are shown in **Table 1**. It can be seen that there are significant differences between male students and female students in the level of task-oriented psychological capital (t=2.756, $P < 0.05$) and innovation ability (t=2.185, $P < 0.05$). Male students have significantly higher levels of task-oriented psychological capital and innovation ability than female students, which is specifically shown in the dimensions of spirit of enterprise and diligence, resiliency and perseverance, optimism, and hope of task-oriented psychological capital, and in the dimensions of practical ability of innovation ability. There are no significant differences in the level of interpersonal psychological capital between male students and female students (t=-0.395, $P > 0.05$).

Table 1. Difference analysis of gender (Mean ± SD)

	Male students (*n*=553)	Female students (*n*=318)	*t*	*P*
1 spirit of enterprise and diligence	3.56±0.94	3.41±0.78	2.603	0.009
2 resiliency and perseverance	3.64±0.90	3.42±0.77	3.799	0.000
3 optimism and hope	3.58±0.94	3.45±0.86	1.998	0.046
4 self-confidence and courage	3.70±0.89	3.69±0.75	0.232	0.817
5 task-oriented psychological capital	3.61±0.85	3.47±0.65	2.756	0.006
6 toleration and forgiveness	3.84±0.84	3.91±0.63	-1.486	0.138
7 modesty and prudence	3.73±0.83	3.70±0.68	0.431	0.667
8 gratitude and dedication	3.88±0.85	3.93±0.69	-0.980	0.327
9 respecting and courtesy	3.71±0.88	3.69±0.79	0.316	0.752
10 personal-oriented psychological capital	3.78±0.79	3.8±0.60	-0.395	0.693
11 independent learning and innovative thinking	3.75±0.76	3.71±0.60	0.935	0.350
12 practical ability	3.21±1.05	3.02±0.87	2.94	0.003
13 innovation ability	3.54±0.77	3.43±0.61	2.185	0.029

The one-way ANOVA was conducted to analyze the grade differences in psychological capital and innovation ability of college students, the variable names represented by 1 to 13 in **Table 2** are the same as the first column in **Table 1**, and the results are shown in **Table 2**, which shows that there are significant differences between college students of different grades in task-oriented psychological capital, but no significant differences in personal-oriented psychological capital and innovation ability. In terms of task-oriented psychological capital, senior students are significantly higher than freshmen and sophomores, and junior students are significantly higher than sophomores, in the dimension of spirit of enterprise and diligence, senior students are significantly higher than freshmen and sophomores, and in the dimension of resiliency and perseverance, junior students

are significantly higher than the freshman and sophomore, and the senior students are significantly higher than the freshman and sophomore, it can be seen that the students' consciousness of motivation and the spirit of resilience and tenacity are stronger in higher grades than that in lower grades.

Table 2. Difference analysis of gender (Mean ± SD)

	(1) (n=277)	(2) (n=303)	(3) (n=162)	(4) (n=129)	F	LSD
1	3.49±0.81	3.41±0.89	3.54±0.89	3.71±0.97	3.678*	(1), (2)<(2)
2	3.49±0.82	3.46±0.85	3.70±0.84	3.73±0.94	5.246**	(1), (2)<(3); (1), (2)<(4)
3	3.47±0.93	3.48±0.89	3.59±0.85	3.68±0.99	2.085	
4	3.63±0.83	3.65±0.83	3.79±0.79	3.82±0.92	2.467	
5	3.51±0.75	3.49±0.78	3.64±0.77	3.73±0.90	3.926**	(1), (2)<(4); (2)<(3)
6	3.87±0.72	3.83±0.79	3.89±0.74	3.90±0.85	0.298	
7	3.66±0.74	3.69±0.78	3.78±0.74	3.84±0.87	2.143	
8	3.88±0.76	3.86±0.81	3.98±0.76	3.96±0.86	1.078	
9	3.65±0.86	3.69±0.80	3.75±0.84	3.79±0.91	1.066	
10	3.76±0.69	3.76±0.74	3.85±0.68	3.87±0.83	1.169	
11	3.72±0.71	3.66±0.66	3.83±0.65	3.80±0.82	2.527	
12	3.06±0.98	3.14±0.91	3.17±1.05	3.32±1.08	2.067	
13	3.46±0.71	3.45±0.68	3.57±0.71	3.61±0.82	2.221	

Note: *$P < 0.05$, **$P < 0.01$; (1): freshman, (2): sophomore, (3): junior, (4): senior; 1–13

Correlation analysis was conducted on the college students' task-oriented and personal-oriented psychological capital, innovation ability, and their various dimensions. The variable names represented by 1 to 13 in **Table 3** are the same as those in the first column in **Table 1**. **Table 3** shows that the above variables and their dimensions are significantly and positively correlated; H1, H1a, H2, and H2a are verified.

Table 3. Pearson correlation analysis

	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1												
2	0.676**	1											
3	0.616**	0.604**	1										
4	0.599**	0.625**	0.652**	1									
5	0.849**	0.856**	0.846**	0.846**	1								
6	0.326**	0.386**	0.373**	0.451**	0.452**	1							
7	0.423**	0.458**	0.472**	0.494**	0.544**	0.640**	1						
8	0.421**	0.438**	0.438**	0.482**	0.524**	0.636**	0.779**	1					
9	0.402**	0.438**	0.427**	0.474**	0.512**	0.548**	0.696**	0.655**	1				
10	0.453**	0.497**	0.494**	0.550**	0.587**	0.833**	0.896**	0.889**	0.831**	1			
11	0.398**	0.428**	0.428**	0.441**	0.499**	0.379**	0.432**	0.449**	0.451**	0.494**	1		
12	0.287**	0.319**	0.283**	0.320**	0.356**	0.194**	0.222**	0.236**	0.227**	0.254**	0.433**	1	
13	0.391**	0.427**	0.402**	0.434**	0.487**	0.317**	0.363**	0.380**	0.375**	0.415**	0.783**	0.900**	1

Note: **$P < 0.01$

3.4. Path analysis

The model fit indices for the impact of college students' psychological capital on innovation ability indicate that x^2/df is 2.827, RMSEA is 0.046, GFI is 0.980, CFI is 0.987, IFI is 0.987, and TLI is 0.982. It can be seen that the model fits well.

The model fitting data is shown in **Figure 1**, and the standardized path coefficients and significance are presented in **Table 4**, the loadings factors of each variable are up to standard, and the path coefficients of personal-oriented and task-oriented psychological capital on the innovation ability of college students are significant, so it can be seen that personal-oriented and task-oriented psychological capital have a significant positive impact on the innovation ability of college students, H3 and H4 are verified.

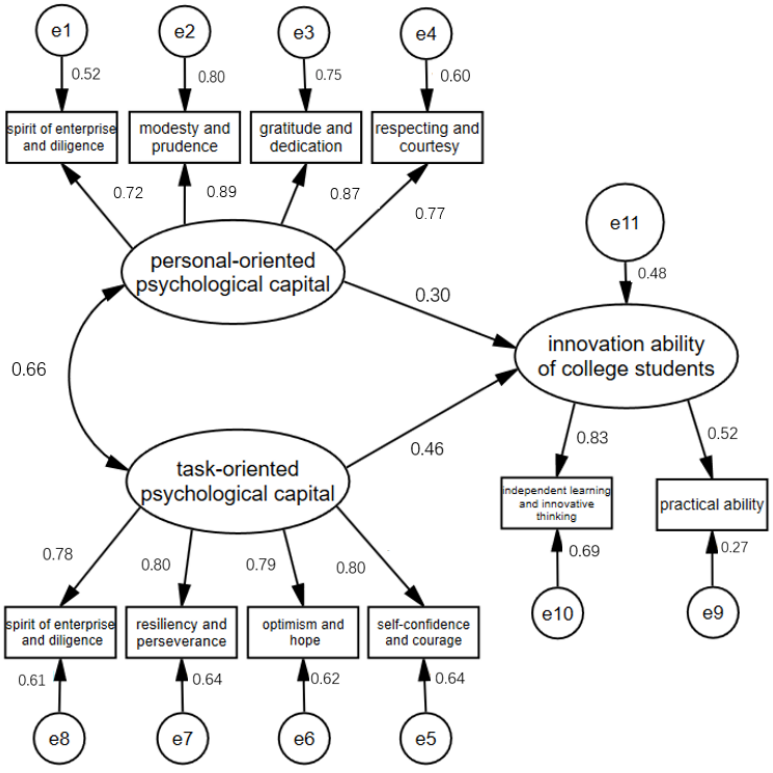

Figure 1. Validation diagram of structural equation modeling

Table 4. Path coefficient

	Estimate	S.E.	C.R.	P	Standard Estimate
innovation ability← personal-oriented psychological capital	0.203	0.038	5.351	***	0.301
innovation ability← task-oriented psychological capital	0.297	0.041	7.256	***	0.458

Note: ***$P < 0.001$

4. Conclusions and suggestions

This study selects independent college students as research subjects and concludes by empirical research that task-oriented psychological capital and its dimensions, personal-oriented psychological capital and its dimensions, and innovation ability and its dimensions are significantly positively correlated with each other, and task-oriented psychological capital and personal-oriented psychological capital have a significant positive

impact on college students' innovation ability. The study proposes the following policies and suggestions to enhance the innovation ability of college students based on the results of data analysis.

4.1. Building a service system

Build a comprehensive psychological counseling service system. On the one hand, it is necessary to guarantee that the daily counseling channels are open. Besides the daily psychological counseling, 24-hour online counseling or telephone hotlines can be set up, allowing students to break through the limitations of time and space to seek help anytime and anywhere when encountering psychological problems. On the other hand, it is necessary to provide good tracking services, for the students who have had a record of counseling or need special concern identified by the psychological assessment, the forms of regular tracking, return visits, participation in activities and so on should be taken to pay attention to their status at different times, encourage them to actively participate in activities and competitions of interest, help them to maintain a positive and optimistic mindset during their school years, and stimulate their creative energies.

Establish a diversified mental health training system. Colleges and universities should strengthen the mental health training for teachers and students, allow teachers of psychological centers, counselors, psychological commissioners, psychological informants and so on to participate in widely, empowering teachers and students through various workshops, salons, psychological group counseling, and quality development activities, improving the level of teachers' and students' psychological capital, combining the cultivation of the heart with the cultivation of the human being, and enhancing the teachers' psychological education ability.

4.2. Strengthening education and guidance

Strengthening the traditional culture education to enhance the level of personal-oriented psychological capital of college students. Through traditional culture and education, college students are guided to be strict with themselves, treat others leniently, cooperate with the surrounding students with tolerance, be kind to others, and learn from outstanding students actively with a humble attitude, maintain a calm attitude when encountering problems, seek cooperation actively, solve confusions and puzzles for the surrounding classmates with dedication, consult teachers and students who have expertise in specific fields respectfully, and get along with students in study groups or competition teams with courtesy.

Strengthening goal education and frustration education to enhance the level of task-oriented psychological capital of college students. Providing personalized guidance and service for students of different grades to solve the problems and confusions that they encountered at various periods, guiding them to set up correct goals. Carrying out psychological education activities that cater to the characteristics of different grades to help students set up goals that are suitable for them, and making plans to stimulate their spirit of enterprising and resilient. In addition, strengthening frustration education, providing guidance on mental health, problem-solving, and counseling in difficult situations, helps students recover a sunny and healthy state of mind and enhances their ability to rebound from the bottom.

4.3. Stimulating innovative vitality

Strengthening school-enterprise cooperation, promoting the integration of industry and education, and encouraging innovation in teaching models. Promoting resource sharing by school-enterprise cooperation, incorporating the cutting-edge technology of enterprises into theoretical teaching, and also applying the

innovative ideas of college students to enterprise practice, promoting scientific and technological innovation and transformation of achievements, providing internship and practical opportunities for students through enterprise platforms to enhance students' practical skills and employment competitiveness. Introducing enterprise mentors to participate in teaching, promoting the innovation of teaching models, encouraging teachers to adopt such teaching forms as flipped classroom, group discussions, situational simulation, and mathematical games to enrich students' learning experience, stimulate students' interest in learning and awareness of autonomous learning, and enhance students' ability of independent learning and innovative thinking.

Creating an innovative environment, encouraging cross-teaming, and stimulating innovative vitality. The data of the study show that male students' task-oriented psychological capital and innovation ability are significantly higher than those of female students, and the scores of spirit of enterprise and diligence, resiliency, and perseverance of students in higher grades are significantly higher than those in lower grades. Therefore, colleges and universities can provide an innovative environment to guide students to form teams across genders or grades during daily activities, participation in competitions, social practices, etc., therefore, colleges and universities can fully exert the driving and radiating effects of students with higher levels of psychological capital, so as to keep the team's overall level of psychological capital in a higher state, thus stimulating the innovative ability of team members.

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