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IMPACT OF SOCIAL CAPITAL ON UNIVERSITY STUDENTS' INNOVATIVE PERFORMANCE: EXPLORING CREATIVE COGNITIVE STYLE AS A MEDIATING VARIABLE

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Abstract

The quest for innovation plays a pivotal role in advancing scientific and societal progress. Higher education endeavors to nurture students' innovation capacities, fostering critical thinking, astute judgment, and the courage to challenge established norms while embracing human civilization's achievements. This study delves into the influence of social capital within social networks on college students' innovative performance. This paper aims to investigate the impact of social capital on college students' innovation performance, discerning its dimensions and mediating effects. It constructs a structural equation model to explore the relationship between college students' social capital (network ties, trust, shared goals) and their innovation performance dimensions (motivation, thinking, personality, achievement). The empirical validation involves a sample of 480 participants. The study delineates college students' social capital and innovation performance into specific dimensions and employs a structural equation model to gauge their interrelation. Social capital comprises network ties, trust, and shared goals, while innovation performance is assessed through motivation to innovate, thinking ability, personality traits, and actual innovation achievements. Empirical validation through structural equation modeling confirms a positive correlation between college students' social capital and innovation performance. Moreover, it highlights the mediating role of college students' cognitive innovation style in this relationship. This scholarly inquiry not only deepens our comprehension of the multifaceted factors influencing college students' innovation but also provides vital insights for educational policy formulation, pedagogical enhancements, and the cultivation of students' innovative prowess.

Keywords: Social Capital, Innovation Performance, Teacher Innovation Support.

1. INTRODUCTION

Innovation is the cornerstone of scientific progress and social advancement, and therefore the cultivation of the innovative capacity of university students is a fundamental goal of higher education. Fostering students' capacity for innovation involves developing their ability to think rationally, make sound judgments and analyze critically, and encouraging them to challenge existing paradigms on the basis of human achievements. This entails questioning established knowledge, embracing originality, exploring and innovating scientific fields, and thus contributing to the continuous progress of society.

China's keen focus on "double creativity" and its promotion of innovation and entrepreneurship has earned unprecedented attention. Scholarly discourses have emphasized that innovation is

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an important driver of productivity (Cainelli et al., 2006; Love & Roper, 2015), sustained economic growth (Zhi & Shudan, 2015), and firm performance (Hou et al., 2019). Notably, Baer et al. (2003) emphasized the important impact of creativity on employee innovation performance. However, the evolving innovation landscape has become intricate, resource-intensive, and risky (Dziallas & Blind, 2019), which has implications for social capital on college campuses.

Understanding the factors and mechanisms that influence innovation among university students is critical to the development of innovators. Exploring these aspects can help educational authorities to formulate relevant policies as well as universities to reform their educational frameworks. This study provides insights into the impact of social capital on university students' innovative performance and also explores the mediating role of innovative cognitive styles.

This study specifically focuses on the innovative performance of university students in university research or practical innovation activities, as distinct from the work-related innovation of corporate employees. It aims to address challenges, accumulate knowledge, develop problem-solving skills, and generate tangible and valuable innovations through novel insights.

The goal of the study is to investigate the direct effect of social capital on college students' innovative performance and the mediating role of innovative cognitive style in the effect of social capital on innovative performance.

2. LITERATURE REVIEW AND HYPOTHESIS

2.1 Definitions of Key Terms

Social capital: Nahapiet and Ghoshal's (1998) three-factor structural theory defines social capital within various social contexts, comprising the structural, relational, and cognitive dimensions. The structural aspect focuses on the breadth and strength of social networks. Relational dimension emphasizes interpersonal connections formed over time, with trust being fundamental in these implicit relationships, stemming from emotional and rational interactions. The cognitive dimension acts as a resource enabling mutual understanding and shared expression among network actors, employing common goals and language for definition.

Creative cognitive style: Individual differences in organizing and processing information consistently, influencing problem comprehension and resolution. This study employs the Adaptive Innovation Scale (KAI inventory) developed by M. Kirton (1976) to measure cognitive styles.

Innovative performance: Efforts to meet the challenges of scientific research or innovation by accumulating knowledge, gaining insights, developing problem-solving skills, and producing valuable results. It consists of two components (Amabile, 1997): intrinsic capabilities and innovative outcomes. Intrinsic competence is related to the physical, intellectual and thinking factors that stimulate innovation, mainly in terms of students' motivation to innovate,

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personality and thinking. Innovative outcomes are recognized novel and practical results, as reflected in publications, conference participation, patents and competition results (McWilliam, 2009).

The modeling assumptions are shown below.

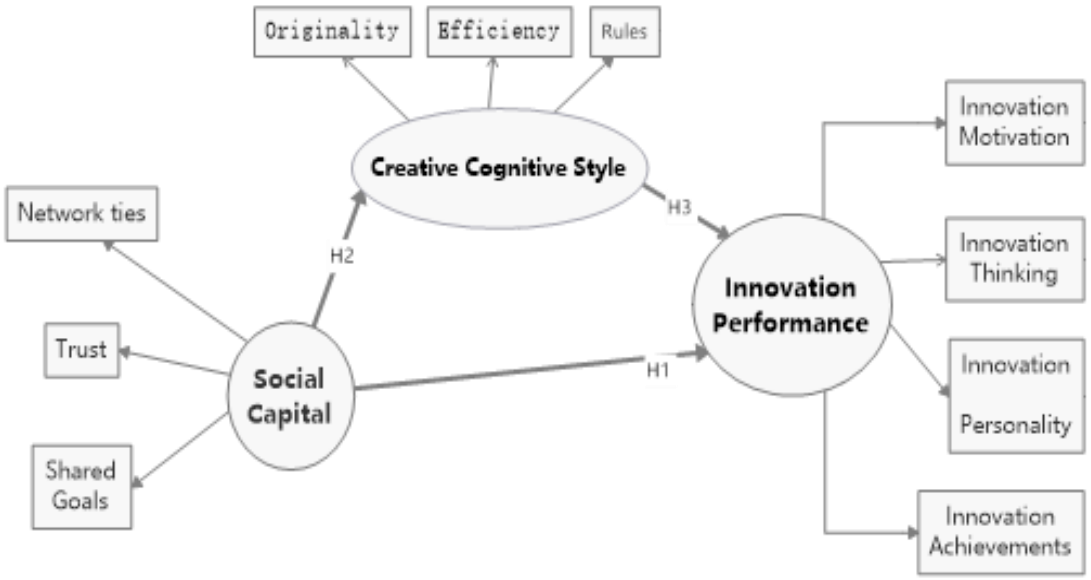

Figure 1: Conceptual Framework: The influence of social capital on college students' innovation performance

2.2 Conceptual model and Hypotheses

Hanna Rydehell (2019) explored the relationship between innovation performance and external financing capabilities by examining patents and product differentiation. Wu Bohong (2018) uses indicators to measure innovation inputs and outputs in Huai'an City and seeks ways to improve innovation performance based on empirical data. Yang Xu (2019) investigated the innovation performance problem of DT companies and proposed a solution by drawing on information asymmetry and R&D management theory. Wang Yi (2020) studied the innovation performance of Haier Group in six years through industry comparison and assessed its innovation process and output.

College students' social capital has an important impact on innovation performance in two ways. First, it promotes motivation to innovate and develops innovative personality traits and innovative thinking, thus improving innovation outcomes and overall performance. A sound social network of college students plays a pivotal role in cultivating innovation ability, facilitating the exchange of innovative ideas, and significantly enhancing innovation motivation, innovative personality, innovative thinking ability, and innovation outcomes.

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3. RESEARCH METHODOLOGY

This part of the researchers used a set of questionnaires to validate the model and hypotheses, aiming to explore the relationship between social capital of university students innovation performance of university students, as well as their internal mechanisms and boundary conditions. The finalized model will be used for data analysis and interpretation.

3.1 Pre-survey

In the pre-survey stage, 58 questionnaires were distributed. After excluding invalid questionnaires, the valid questionnaires of the pre-survey were 51, and the effective recovery rate of the samples was 87.93%. After the reliability analysis of the pre-survey, "Cronbach Alpha if Item Deleted", CITC (Corrected Item-Total Correlation), item analysis, and expression accuracy or not of the four analytical treatments, and after the expert's advice, retained 44 items, the model relationship and items are shown below figure 2.

3.2 Population and Sample

The data came from universities in the top three largest cities in Guangxi Province China, covering different majors and different grades. The questionnaires were collected online, and finally 540 responses were obtained, and after deleting invalid and incomplete questionnaires, the number of valid questionnaires was 480, with a validity rate of 88.88%.

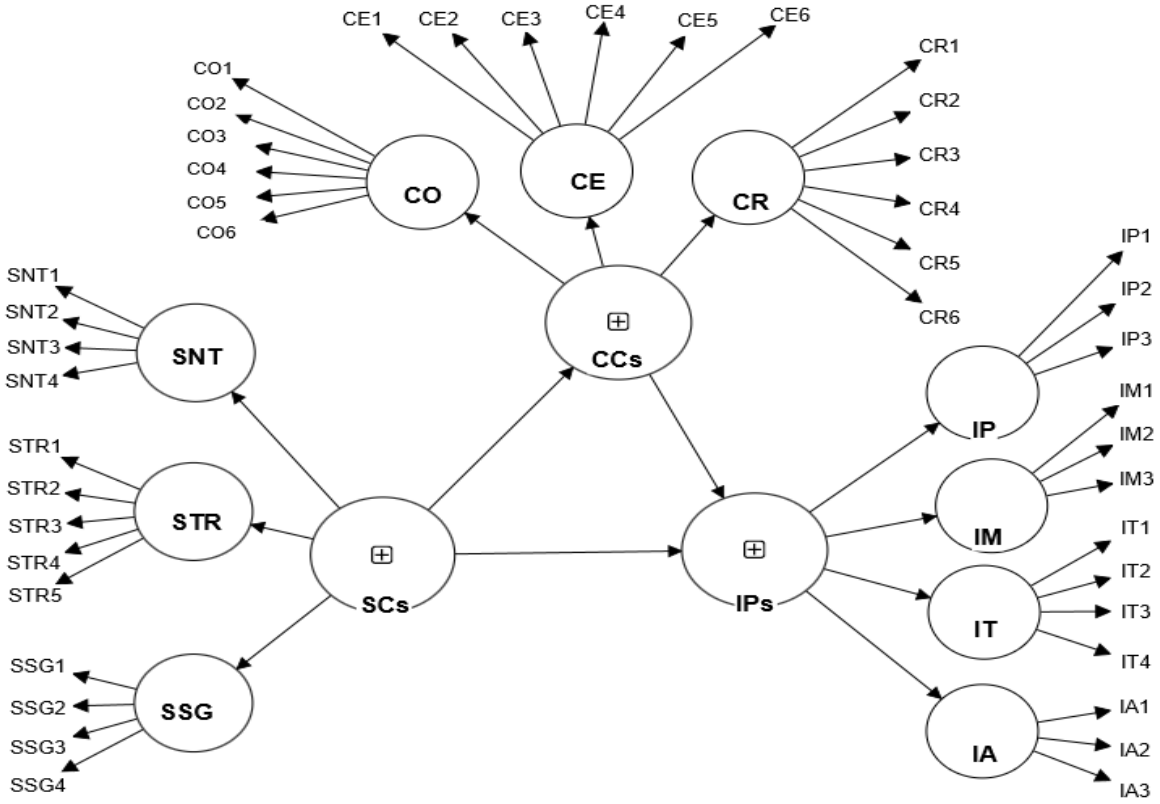

Figure 2: Model diagrams and their question items identified after the pre-survey

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3.3 Instrument

Of all the scales, the study used a 5-point Likert subscale, with 5 indicating agreement and 1 indicating complete disagreement.

Table 1: Specific references to the scale sources and included question items

variable& Encoding	Measurement Dimension	Encoding of items	References
Innovation Performance (IPs)	Innovation Motivation	IM1-3	Amabile（1997） (Liu & Fan, 2020) (Kukkonen & Bolden, 2022)
	Innovation Personality	IP1-3	
	Innovation Thinking	IT1-4	
	Innovation Achievement	IA1-3	
Social Capital (SCs)	Network Tie	SNT1-4	(Nahapiet & Ghoshal, 1998) Chow&Chan（2008） (Zhang Y., 2014) (Wang et al., 2020)
	Trust	STR1-5	
	Shared Goal	SSG1-4	
Creative Cognitive Style (CCs)	Originality	CO1-6	Kirton(1976) (Zhang et al., 2018)
	Efficiency	CE1-6	
	Rule	CR1-6	

Data source: Author's compilation based on references

4. DATA ANALYSIS AND RESULTS

The study employed quantitative analysis to present its findings. As the data originated from a single source, the potential for common method variance (CMV) was acknowledged. To assess CMV in the partial least squares structural equation modeling, two techniques were employed: a comprehensive examination of covariance utilizing the variance inflation factor (VIF) as proposed by Kock (2015) and a correlation matrix procedure. Neither of these methods revealed any bias in the single-source data.

4.1 reliability and validity

It's important to highlight that **Error! Reference source not found.** presents both the first-order and second-order variables simultaneously. Whether they are first-order or second-order, the table indicates that these reflective dimensions exhibited Cronbach's α and CR values exceeding 0.70. Additionally, all scales showcased AVE values surpassing 0.50, thereby confirming the convergence validity of these dimensions/constructs.

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Table 2: Data Reliability and Convergent Validity Tables

Constructs and Items	Cronbach's alpha	CR Value	AVE Value
Step I: First-order reflective components were evaluated.			
IM	0.851	0.909	0.77
IP	0.847	0.907	0.766
IT	0.895	0.927	0.76
IA	0.861	0.915	0.783
SNT	0.894	0.926	0.759
STR	0.897	0.924	0.709
SSG	0.883	0.92	0.741
CO	0.924	0.936	0.725
CE	0.917	0.936	0.708
CR	0.899	0.922	0.664
Step II: The second-order reflective construct is presented here			
IPs	0.771	0.853	0.593
SCs	0.751	0.858	0.668
CCs	0.721	0.843	0.642

For evaluating discriminant validity, HTMT criteria was utilized for the inner construct. All HTMT values in the table are less than 0.85, implying that there is a good differentiation between the three measures of social capital, innovation cognitive style and innovation performance, and that the data under study has a good differentiation validity between the three scales.

Table 3: HTMT Validity Test

	CCs	IPs	SC
CCs	-		
IPs	0.61		
SC	0.648	0.605	-

4.2 Hypothesis testing

The R-squared values of CCs, IPs and SFs are all between 0.33 and 0.67, indicating a moderate interpretation.

The effect sizes compiled in this study are shown in the table below. Effect size (f2) , the effect value influences the effect at a level of 0.35 (high), 0.15 (medium), and 0.02 (low) from high to low (Cohen, 1988). The effect size of SCs>CCs is high (0.305), while the effect size of two relationships are mid-to-low, which is not high but still within the critical values.

Table 4: Effect size (f2)

	CCs	IPs
CCs		0.106(mid-to-low)
SC	0.305(medium)	0.103(mid-to-low)

Q-square. Following the procedure suggested by Shmueli et al. (2016), the current implementation of the PLSpredict algorithm in the SmartPLS software allows researchers to obtain k-fold cross-validated prediction errors and summary statistics of prediction errors,

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which can be used to compare their prediction performance with two naïve benchmarks (Shmueli et al., 2019).

(1) Q^2value in PLSpredict compares the prediction error of a PLS path model to the simple average prediction. If the Q^2 value is positive, the PLS-SEM model has better prediction performance.

(2) The prediction error (e.g., RMSE or MAE) of the PLS-SEM results should be lower than the prediction error of the LM results when compared to the LM results

(3) The prediction error of PLS-SEM results should be lower than that of LM results.

Table 5 provide the Q^2predict values for the model's explicit variables (dimensions), and all values are greater than 0, so the dimensions have predictive power. The PLS-SEM_RMSE < LM_RMSE for most of the metrics indicates that the model has medium predictive power.

Table 4: PLSEpredict assessment of Manifest Variables

	Q^2predict	PLS-SEM_RMSE	PLS-SEM_MAE	LM_RMSE	LM_MAE
CE	0.136	0.931	0.796	0.935	0.801
CO	0.161	0.918	**0.785**	0.92	0.784
CR	0.15	0.923	0.782	0.926	0.783
IA	0.12	0.939	0.798	0.943	0.801
IM	0.142	0.928	0.781	0.931	0.783
IP	0.105	0.948	0.8	0.95	0.802
IT	0.134	0.932	**0.789**	0.935	0.789

In Table 6, the Q^2predict values for the latent variables are all greater than 0, which indicates that the PLS-SEM model is able to predict the latent variables with moderate to good accuracy. The RMSE values and MAE values also indicate that the PLS-SEM model is able to predict the latent variables with moderate to good accuracy.

Table 5: PLSEpredict assessment of Latent Variables

	Q^2predict	RMSE	MAE
CCs	0.229	0.88	0.722
IPs	0.211	0.891	0.739

4.2.1 Path analysis and hypothesis testing for structural modeling

The magnitude and significance of the path coefficients were used to assess the relationship between the research constructs. The results of calculating the path coefficients and T-values using Bootstrapping method are shown below Figure 3 and Table4.

In Figure 3, the results of the path analysis test demonstrate significant relationships in this study. Both social capital (SCs -> IPs, β=0.314, $p<0.001$) and cognitive styles of innovation (CCs -> IPs, β=0.311, $p<0.001$) exhibit a positive influence on innovation performance (IPs). As a result, hypotheses H1 and H2 are supported and cannot be rejected. Moreover, hypothesis H3, which posits a positive influence of innovation cognitive style (CCs -> IPs, β=0.311, $p<0.001$) on innovation performance, is also supported. Thus far, all direct effects in the model have been validated, confirming the support for hypotheses H1-H3.

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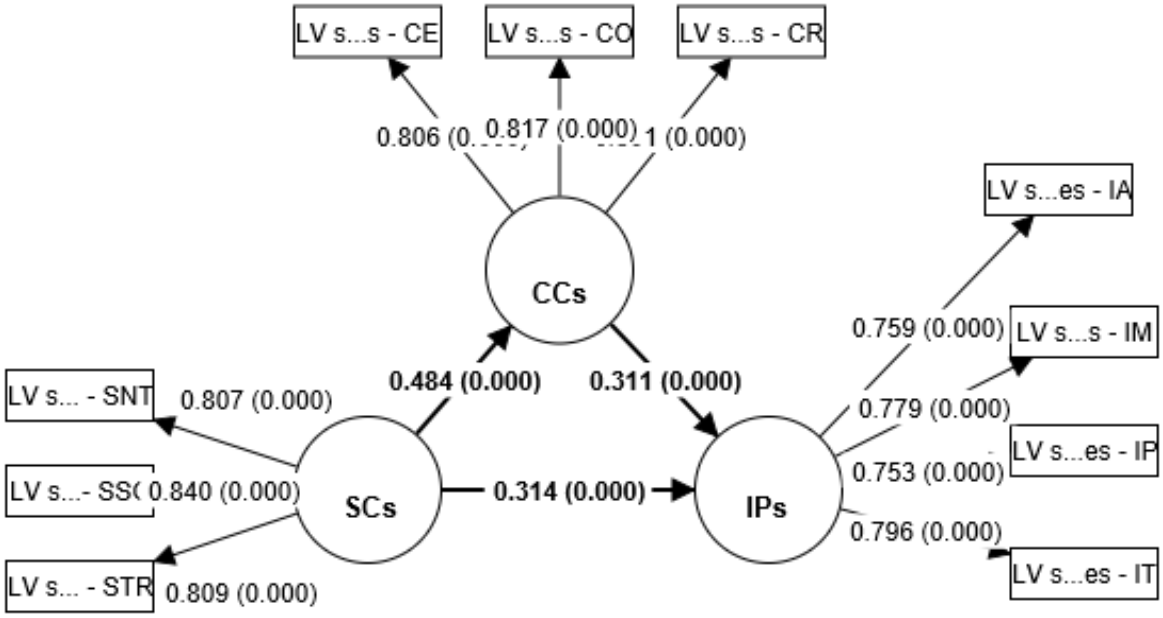

Figure 3: Path relationship

4.2.2 Mediation Testing Hypothesis

In this study, the mediation role of CCs in the relationship between the variables SCs with IPs was examined using the Bootstrap mediation effect test. The test was conducted with a 95% Bias Corrected confidence interval and 5000 repetitions to determine the significance of the mediation effect. The results of the mediation effect test are presented in Table 7. total effect for SCs -> IPs (β=0.464, p<0.001), The obtained p-values were below the critical values for statistical significance, 0.001, with values surpassing the critical value of 1.96, indicating statistical significance. These findings provide substantial evidence supporting the mediating effect of CCs.

Table 7: Total effects and specific indirect effects- Mean, STDEV, T values, p values

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
CCs -> IPs	0.311	0.31	0.047	6.571	0
SCs -> CCs	0.484	0.485	0.035	13.691	0
SCs -> IPs	0.464	0.466	0.037	12.635	0
SCs -> CCs -> IPs	0.15	0.15	0.025	6.021	0

The analysis from Table 7 highlights specific mediation pathways. SCs -> CCs -> IPs path, totaling an indirect effect value is 0.464. The mediation effect of SCs -> SFs -> IPs is 0.15, accounting for 32.32% of the total indirect effect. This confirms Hypothesis 4, indicating a partial mediator effect due to the presence of a direct effect from SCs to IPs.

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5. CONCLUSION AND DISCUSSION

5.1 Conclusion

In this study, the proposed hypotheses were thoroughly tested using quantitative analysis techniques. The results of the study indicate that there is a significant relationship between college students' social capitals (SCs) and their innovation performance (IPs), as well as between college students' cognitive styles of innovation (CCs) and their innovation performance (IPs). In addition, college students' social capital has a significant effect on their cognitive styles of innovation (CCs).

The mediating role of innovation cognitive styles (CCs) between social capitals (SCs) and innovation performance (IPs) was also confirmed, affirming some of its mediating effects. Moreover, social capital has a relatively strong level of predicting cognitive style of innovation (KAI) and innovation performance. The results of the study emphasize the urgent need for educational institutions and instructors to prioritize the development of students' social networks and psychological resilience in order to promote the comprehensive and holistic development of their innovative capabilities.

5.2 Discussion

The study's results underscore the influential role of both social capital and innovative cognitive style in shaping university students' innovation performance. The positive impact of social capital on fostering innovative cognitive styles among students highlights the significance of robust social networks and exposure to diverse knowledge in enhancing creativity. Moreover, the mediating effect of innovative cognitive style signifies its pivotal role in channeling the influence of social capital onto innovation performance. These findings offer essential insights into the complex interplay between social factors and individual cognitive attributes in driving innovation among students.

5.3 Limitations and Future Perspectives

While the study offers valuable insights, there remains an avenue for refinement in terms of sample diversity and data depth. Augmenting the breadth of the sample pool and diversifying data collection methodologies could substantially enrich our understanding of the multifaceted factors that wield influence over innovation capabilities. Moreover, the contextual specificity of the study warrants its validation across diverse cultural and social milieus.

Prolonged longitudinal studies could unveil the enduring impacts of social capital and faculty support on innovation prowess. Further investigations exploring additional mediating variables could unravel nuanced layers of the impact of social capital and faculty guidance. Consideration of comparative studies spanning students from myriad backgrounds might illuminate a more comprehensive spectrum of influential factors at play in shaping innovation capacities.

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