The Correlation Between Students' Innovation Capacities and Creative Self-Efficacy at H University, Shandong Province, China

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Abstract: This study took students from H University in Shandong Province, China, as the research subjects. It aimed to explore the current levels of students' innovation capacities and creative self-efficacy, analyze the differences between the two variables across different demographic background variables, and examine the correlation between them. A questionnaire survey method was adopted for data collection, with 379 questionnaires distributed and 370 valid questionnaires recovered. The research instruments included the H University Students' Innovation Capacities and Creative Self-Efficacy Questionnaire. Descriptive statistical analysis, an independent-samples t-test, one-way ANOVA, and Pearson correlation analysis were used for data processing. The results showed that the overall level of students' innovation capacities in H University, Shandong Province, China, was moderate. Creative cognition, intention to innovate, and risk taking were at moderate levels. The overall level of creative self-efficacy was moderate. Efficacy of creative thinking (ECT) was relatively high, while efficacy of creative production (ECP) and persistence of efficacy in the face of negative feedback (PEFNF) were at moderate levels. Regarding demographic background variables, students' innovation capacities differed significantly by gender, grade, and subject, with partial significant differences by only-child. Creative self-efficacy differed significantly by gender, grade, subject, and only-child. There was a significant positive correlation between students' innovation capacities and creative self-efficacy.

Keywords: Innovation Capacities, Creative Self-Efficacy, College Students.

1. Introduction

Against the rapid transformation of the global economy and the deep integration of digital technologies, innovation has become a key driver of national competitiveness and sustainable development. Traditional higher education models centered on knowledge transmission are no longer sufficient to meet the demand for innovative talents, making the cultivation of students' innovation capacities increasingly important (Yodchai et al., 2022). As emphasized by UNESCO in Reimagining Our Futures Together, higher education should foster students' creativity, initiative, and problem-solving abilities through reforms in teaching and learning (Alhadihaq et al., 2024). However, even within similar innovation education environments, students show significant differences in innovation engagement and performance (Vamvaka et al., 2020; Vieira et al., 2024). Research further indicates that such differences are closely related to students' confidence in their own abilities, particularly creative self-efficacy, which influences their willingness to propose new ideas, cope with failure, and persist in innovation tasks.

In the context of China's high-quality economic development, innovation has become the core driving force of national progress, and higher education plays an increasingly important role in cultivating innovative talents (Kuo et al., 2019). With the advancement of the digital economy and industrial upgrading, the demands on college graduates have shifted from knowledge mastery to innovation capacities, practical abilities, and problem-solving skills in complex contexts, making innovation capacities a key indicator of higher education quality (Fang & Chang, 2023). Guided by national strategies, China has promoted the transformation of higher education from knowledge-oriented to ability-oriented, continuously strengthening innovation and

entrepreneurship education through curriculum reform, practical projects, and industry–university collaboration (Wei et al., 2019).

However, despite improved educational resources and policy support, significant differences remain in students' innovation engagement and outcomes. Research suggests that these differences are not only determined by external conditions but are also closely related to students' internal motivation, confidence, and self-perception of their abilities (Liu et al., 2019). As a result, recent policies have begun to emphasize stimulating students' learning initiative and enhancing their confidence in dealing with innovative tasks. Therefore, examining innovation capacities from the perspective of creative self-efficacy helps explain the variation in innovation performance and reveals the internal mechanism of innovation education at the individual level (Xu, 2024).

Despite H University's efforts in innovation education, significant differences still existed in students' innovation capacities. When facing complex innovative tasks and challenging projects, some students showed low innovation engagement and creativity. This phenomenon might have stemmed from the level of students' creative self-efficacy. Therefore, understanding the relationship between innovation capacities and creative self-efficacy of students in H University was of important theoretical and practical value for optimizing innovation education and improving students' innovative performance.

Research Objectives

T1) To understand the status of students' innovation capacities in H University, Shandong Province, China.

2) To understand the status of creative self-efficacy in H University, Shandong Province, China.

3) To analyze the significant differences in students' innovation capacities in H University, Shandong Province, China under different demographic background variables.

4) To analyze the significant differences in creative self-efficacy in H University, Shandong Province, China under different demographic background variables.

5) To explore the correlation between students' innovation capacities and creative self-efficacy in H University, Shandong Province, China.

Conceptual Framework

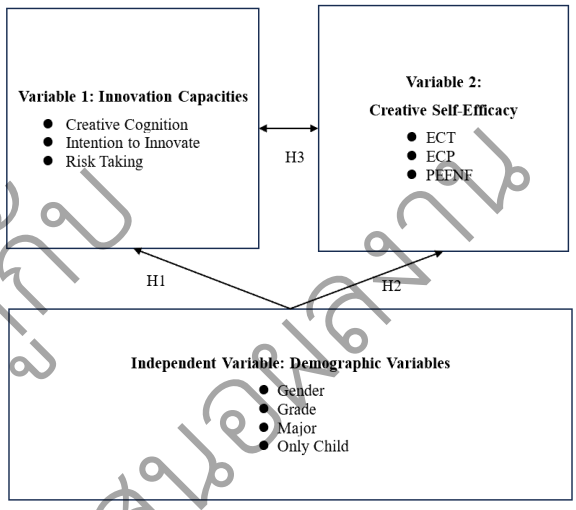

Figure. 1: Research Conceptual Framework

Literature Review

Social Cognitive Theory

Social Cognitive Theory, proposed by Bandura (1997), suggests that individual behavior is shaped by the interaction of cognition, behavior, and environment. Within this framework, self-efficacy refers to individuals' confidence in completing tasks. Research has shown that self-efficacy significantly affects students' academic achievement and innovation performance by enhancing motivation, effort, and persistence (Alsunaydi, 2025; Green & Rizwan, 2024).

Studies further indicate that students with higher self-efficacy are more likely to actively participate in innovative activities, show stronger resilience, and achieve better outcomes, while those with lower self-efficacy tend to avoid challenges (Chen et al., 2022). Creative self-efficacy has a direct positive effect on students' innovative behaviors and performance. Therefore, Social Cognitive Theory provides a clear framework for explaining students' innovation capacities. Self-efficacy plays a key role in determining students' engagement and persistence in innovation tasks, and this study proposes that creative self-efficacy significantly influences

students' innovation capacities.

Componential Theory of Creativity

Componential Theory of Creativity, proposed by Amabile (2018), argues that creativity results from the interaction of three key components: domain-relevant skills, creativity-relevant thinking skills, and task motivation. Among these, intrinsic motivation is the core driving force that transforms potential abilities into actual creative performance. The theory further highlights that motivation influences not only the initiation of creative behavior but also the persistence and depth of engagement in the creative process. Empirical studies show that even when students possess sufficient knowledge and thinking skills, their creative potential is difficult to realize without strong motivation (Ramesh & Klaiber, 2026). Intrinsic motivation significantly affects individuals' engagement and performance in complex and uncertain innovation tasks (Said & Jamal, 2020), while positive beliefs about one's abilities further support sustained creative effort (Sapci et al., 2021). Students with higher motivation are more likely to actively participate in innovation, persist through challenges, and produce higher-quality outcomes (Suherman & Vidákovich, 2024).

Innovation Capacities

Innovation capacities refer to individuals' ability to generate novel ideas and effectively transform them into practical solutions when facing complex problems, and this ability is multidimensional, involving knowledge, creative thinking, and motivation (Amabile, 2018). It is not innate but gradually developed through education and experience, and it can be continuously improved through learning and practice, making it a process-oriented and cultivable outcome in higher education (Selznick & Mayhew, 2019). Existing research shows that innovation capacities can be enhanced through innovative courses, interdisciplinary learning, and project-based activities, which provide opportunities for practical problem-solving and experimentation (Mayhew et al., 2018), while studies have also expanded to organizational and social levels, linking innovation capacities with performance and competitiveness (Kuo et al., 2019). In terms of measurement, innovation capacities are usually treated as multidimensional constructs, including creative cognition, intention to innovate, and risk taking, or cognitive, affective, and behavioral dimensions (Selznick & Mayhew, 2018; Usman & Nia, 2019), although most tools rely on self-report data and focus on individual performance. In the Chinese context, students' innovation capacities are influenced by both individual characteristics and external factors such as curriculum design, teaching methods, and educational environment (Liu et al., 2019; Chen & Ma, 2024), and practices such as interdisciplinary projects and innovation competitions have been shown to effectively enhance students' creative thinking and problem-solving abilities, though the cultural adaptability of measurement tools and the need for diversified educational models remain important issues for future research.

Creative Self-Efficacy

Creative self-efficacy refers to individuals' belief in their ability to generate and implement innovative ideas when facing creative tasks, and its theoretical foundation originates from Social Cognitive Theory proposed by Bandura (1997). It is a key factor influencing students' innovative behaviors, persistence, and academic performance, as individuals with higher creative self-efficacy tend to show stronger engagement, motivation, and resilience in challenging tasks (Green & Rizwan, 2024; Chen et al., 2022). Although generally considered a positive psychological resource, its effects may vary depending on context, gender, and subject differences, showing certain situational characteristics (Ulger, 2018). In terms of measurement, creative self-efficacy is usually assessed through self-report scales covering dimensions such as efficacy of creative thinking (ECT), efficacy of creative production (ECP), and persistence of efficacy in the face of negative feedback (PEFNF) (Yang & Hsu, 2020), though such tools may be influenced by bias and lack dynamic and contextual considerations. In the Chinese context, research shows that creative self-efficacy plays an important role in improving students' academic achievement, innovative behaviors, and mental health, and can be

effectively enhanced through innovation-oriented courses and educational interventions (Nan & Song, 2022; Xu, 2024), although further research is needed to explore its application across different disciplines and educational settings.

Research on the Differences in Students' Innovation Capacities and Creative Self-Efficacy Under Different Background Variables

With the growing emphasis on cultivating innovative talents in higher education, research has increasingly focused on individual differences in students' innovation capacities and creative self-efficacy across background variables. Findings on gender differences are mixed: male students may report higher innovation capacities in fields such as engineering and technology, influenced by gender roles and disciplinary culture, while female students often show equal or even stronger stability and persistence in creative fields like arts and humanities (Chen & Ma, 2024; Fang & Chang, 2023). In terms of grade level, innovation capacities and creative self-efficacy do not develop linearly, and senior students may experience periodic declines due to increased academic pressure (Vodă & Florea, 2019; Wei et al., 2019). Subject background is also a key factor, with science and engineering students excelling in problem-solving but sometimes showing lower creative confidence, while humanities and art students tend to demonstrate stronger creative self-belief (Chen et al., 2022; Green & Rizwan, 2024). Additionally, family cultural capital and educational support influence students' early experiences and self-perceptions, though these differences can be reduced through university education and institutional support (Fernández-Morante et al., 2022).

2. Materials and Methods

This study recruited full-time students from H College in Shandong Province, China, covering diverse demographic backgrounds to support the analysis of group differences in students' innovation capacities and creative self-efficacy. Based on Krejcie and Morgan's (1970) sample size criteria for a population of 27,275 students, a total of 379 questionnaires were distributed to meet the required statistical reliability at a 95% confidence level and 5% sampling error, and 370 valid responses were finally obtained after data screening, with a valid response rate of 97.63%.

Reliability results showed that Cronbach's α coefficients for all dimensions were above .60, and overall values exceeded .70, indicating good reliability. Validity analysis indicated that KMO values were above .80 and Bartlett's test was significant ($p < .001$), confirming that the scales were suitable for factor analysis and had good validity. SPSS was used to conduct descriptive statistics, independent-samples *t*-tests, one-way ANOVA, and Pearson correlation analysis to examine the status, differences, and relationship between students' innovation capacities and creative self-efficacy.

3. Results

This study selected full-time students from H University in Shandong Province, China, as research subjects. A total of 379 questionnaires were distributed, and 370 valid questionnaires were recovered, with an effective recovery rate of 97.63%. In terms of gender, 189 were male students (51.08%), and 181 were female students (48.92%), showing a relatively balanced distribution. Regarding grade, 80 were freshmen (21.62%), 99 were sophomores (26.76%), 91 were juniors (24.59%), and 100 were seniors (27.03%), indicating a balanced distribution across grades. In terms of subject, 66 students (17.80%) were from science and engineering, while 304 students (82.20%) were from non-science and engineering fields. For only-child status, 137 students (37.03%) were only-children, and 233 students (62.97%) were non-only-children. Overall, the sample showed reasonable and balanced demographic characteristics, providing a solid basis for analyzing the relationship between students' innovation capacities and creative self-efficacy.

Table. 1: Demographic Background of Students

Background Variables	Options	N	%
Gender	Male	189	51.08
	Female	181	48.92
Grade	Freshman	80	21.62
	Sophomore	99	26.76
	Junior	91	24.59

Background Variables	Options	N	%
	Senior	100	27.03
Whether an Only Child	Only Child	137	37.03
	Non-Only-Child	233	62.97
Subject	Science and Engineering	66	17.80
	Non-Science and Engineering	304	82.2
Total		370	100.00

1) This study used descriptive statistical analysis to examine the status of students' innovation capacities and creative self-efficacy at H University in Shandong Province, China. The results showed that overall innovation capacities were at a moderate level (M = 3.29, SD = 0.46), with creative cognition (M = 3.28), intention to innovate (M = 3.31), and risk taking (M = 3.27) at a moderate and relatively balanced level. Similarly, students' creative self-efficacy was at a moderate level overall (M = 3.47, SD = 0.50), with efficacy of creative production (M = 3.48) and persistence of efficacy in the face of negative feedback (M = 3.48) slightly higher than efficacy of creative thinking (M = 3.45).

Table. 2: Descriptive Statistics of Students' Innovation Capacities

Dimension	n	M	SD	Interpretation
Creative Cognition	370	3.28	.52	Moderate
Intention to Innovate	370	3.31	.52	Moderate
Risk taking	370	3.27	.49	Moderate
Total	370	3.29	.46	Moderate

Table. 3: Descriptive Statistics of Students' Creative self-efficacy

Dimension	n	M	SD	Interpretation
ECT	370	3.45	.56	Moderate
ECP	370	3.48	.55	Moderate
PEFNF	370	3.48	.54	Moderate
Total	370	3.47	.50	Moderate

2) This study used independent-samples t-tests and one-way ANOVA to examine differences in students' innovation capacities across demographic variables. The results showed that male students scored higher than female students in all dimensions, including creative cognition (M = 3.37 vs. 3.19), intention to innovate (M = 3.37 vs. 3.25), risk taking (M = 3.33 vs. 3.21), and total level (M = 3.36 vs. 3.21), with significant differences. Seniors scored the highest among all grades in each dimension and total innovation capacities (M = 3.48, p < .001), indicating an increasing trend with grade level. Science and engineering students also scored significantly higher than non-science and engineering students across all dimensions, such as total level (M = 3.62 vs. 3.22, p < .001). For only-child status, non-only children scored higher in creative cognition (M = 3.37 vs. 3.23, p < .01) and total level (M = 3.35 vs. 3.25, p < .05), while no significant differences were found in other dimension.

3) This study used independent-samples t-tests and one-way ANOVA to examine differences in students' creative self-efficacy across demographic variables. The results showed significant gender differences, with male students scoring higher than female students in efficacy of creative thinking (M = 3.59 vs. 3.29), efficacy of creative production (M = 3.61 vs. 3.34), persistence of efficacy in the face of negative feedback (M = 3.60 vs. 3.35), and total level (M = 3.60 vs. 3.33), all at p < .001. Significant grade differences were also found, with seniors scoring the highest in all dimensions, including total creative self-efficacy (M = 3.75, p < .001). In terms of subject, science and engineering students scored significantly higher than non-science and engineering students across all dimensions, such as total level (M = 3.84 vs. 3.39, p < .001). Regarding only-child status, non-only children scored higher than only children in all dimensions, including total level (M = 3.62 vs. 3.38, p < .001).

4) This study used Pearson correlation analysis to examine the relationship between students' innovation capacities and creative self-efficacy. The results showed that all dimensions of innovation capacities were significantly positively correlated with all dimensions of creative self-efficacy (p < .001). Specifically, total innovation capacities were positively correlated with efficacy of creative thinking (r = .581), efficacy of creative production (r = .590), persistence of efficacy in the face of negative feedback (r = .623), and overall creative self-efficacy (r = .661). Similarly, creative cognition, intention to innovate, and risk taking all showed moderate to strong positive correlations with creative self-efficacy dimensions (r = .473–.645). These findings indicate that higher creative self-efficacy was associated with stronger innovation capacities.

4. Discussion

The results showed that both students' innovation capacities and creative self-efficacy were at a moderate level. This was consistent with Ramesh and Klaiber (2026), indicating that although students had a foundation in innovation, there was still room for improvement, especially in practical application and risk taking. Similarly, creative self-efficacy was moderate, aligning with Li and Wang (2025), suggesting that students had some confidence in creative thinking but were relatively weaker in transforming ideas into practice and maintaining persistence under challenges.

In terms of differences, gender, grade, subject, and only-child status all showed varying effects. Male students performed higher in innovation capacities and creative self-efficacy, which was consistent with Green and Rizwan (2024), possibly due to differences in socialization and self-evaluation. Grade differences showed a clear upward trend, with seniors scoring the highest, supporting Adiguzel et al. (2023) and Li and Wang (2025), reflecting the accumulation of knowledge and experience. Subject differences indicated that science and engineering students performed better, consistent with Duong (2025), due to a stronger emphasis on practice and problem-solving. For only-child status, non-only children showed partial or significant advantages, which echoed Chen and Ma (2024), suggesting that early social interaction and family environment may influence innovation-related development.

Finally, there was a significant positive correlation between innovation capacities and creative self-efficacy, supporting Green and Rizwan (2024) and Fernández-Morante et al. (2022). This indicated that higher creative self-efficacy was associated with stronger innovation capacities. As an important psychological factor, self-efficacy influenced students' motivation, persistence, and engagement in innovative activities. Therefore, improving students' creative self-efficacy was essential for enhancing their innovation capacities.

5. Recommendation

This study proposes three practical strategies for improving college students' innovation development: universities should build a multi-level and grade-progressive innovation training system with differentiated curriculum and practical activities to enhance students' innovation capacities, establish a systematic psychological support mechanism involving practical opportunities, positive teacher feedback, and tutor guidance to strengthen students' creative self-efficacy, and develop a collaborative development model integrating capacity cultivation and efficacy reinforcement with continuous evaluation and dynamic adjustment to form a virtuous interactive cycle between innovation capacity and creative self-efficacy.

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