

# Empirical Study on the Enhancement of Innovation and Entrepreneurship Ability of College Students in Shaanxi Province through Digital Empowerment

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## ABSTRACT

With the accelerated promotion of digital transformation in higher education, how to use digital means to empower innovation and entrepreneurship education and enhance the innovation and entrepreneurship abilities of college students has become an important issue in the current field of higher education. This study has important theoretical and practical value for universities to implement educational digitization, enhance college students' innovation and entrepreneurship abilities, and improve the quality of innovation and entrepreneurship education.

## KEYWORDS

digital background; college student; Innovation and entrepreneurship ability; Path model; Suggestions for countermeasures

## 1 Introduction

With the rapid development of digital technology, human society is undergoing unprecedented changes, among which the digital transformation of higher education is particularly noteworthy. In this context, how to fully utilize digital means to enhance the innovation and entrepreneurship abilities of college students has become an important issue that urgently needs to be addressed in the field of higher education. This article aims to explore the paths and strategies for enhancing the innovation and entrepreneurship abilities of college students in the context of digitalization. By constructing a path model and conducting a questionnaire survey for verification, it provides theoretical basis and practical guidance for universities to implement educational digitization.

## 2 Innovation and Entrepreneurship Capability: Background, Development Trends, and Opportunities for Digital Transformation

### 2.1 Background of the emergence of innovation and entrepreneurship capabilities

With the acceleration of globalization and the rapid development of technology, innovation and entrepreneurship have become important ways to promote economic growth, employment, and improve social welfare. Governments around the world have adopted innovation driven development as a national strategy, committed to cultivating high-quality talents with innovative spirit, entrepreneurial awareness, and entrepreneurial ability. In this context, innovation and entrepreneurship education in universities has emerged as an important cradle for cultivating future entrepreneurs and innovators.

### 2.2 The current situation and challenges of innovation and entrepreneurship education in universities

The Chinese government attaches great importance to innovation and entrepreneurship education in universities, incorporating it into the entire process of talent cultivation, with the aim of enhancing the innovation and entrepreneurship abilities of college students through deepening educational and teaching reforms. However, despite significant achievements, current innovation and entrepreneurship education in universities still faces many challenges. On the one hand, some universities still have the problem of emphasizing theory over practice and form over content in innovation and entrepreneurship education, which makes it difficult for students' innovation and entrepreneurship abilities to be effectively improved. On the other hand, due to the limitations of entrepreneurs' own innovation and entrepreneurship abilities, market insights, and the uncertainty of the entrepreneurial environment, entrepreneurial risks remain high, and many entrepreneurial projects are difficult to sustain.

### 2.3 Opportunities and impacts of digital transformation in higher education

The rapid development of digital technology has brought unprecedented opportunities for transformation to higher

education. China's higher education has gone through three stages of development in teaching digitization, from MOOC construction to blended learning, and then to online and integrated teaching.

### 3 Hypothetical Model for Enhancing Innovation and Entrepreneurship Capabilities

The core investigation of this paper focuses on the specific forms of digitalization in higher education, how to construct a digital education path model that can effectively enhance college students' innovation and entrepreneurship abilities, and how to verify the effectiveness of this path model through empirical data. Based on in-depth analysis and synthesis of existing literature, this project extracts and proposes the following five core hypotheses, aiming to provide a theoretical framework and empirical guidance for subsequent research:

Assumption 1: Digitalization of higher education enhances college students' innovation and entrepreneurship abilities by providing and creating data. The use of Internet, mobile Internet, big data, artificial intelligence, metauniverse and other forms in college education can provide and create data, which can help college students improve their innovation and entrepreneurship ability.

Assumption 2: Digitalization of higher education enhances college students' innovation and entrepreneurship abilities by providing and creating knowledge. The use of Internet, mobile Internet, big data, artificial intelligence, metauniverse and other forms in college education can provide and create knowledge, which can help college students improve their innovation and entrepreneurship ability.

Assumption 3: Digitalization of higher education enhances college students' innovation and entrepreneurship abilities through resource sharing. The use of Internet, mobile Internet, big data, artificial intelligence, metauniverse and other forms in college education can share resources, which can help students improve their innovation and entrepreneurship ability.

Assumption 4: Digitalization of higher education enhances college students' innovation and entrepreneurship abilities through resource collaboration. The use of Internet, mobile Internet, big data, artificial intelligence, metauniverse and other forms in college education can help students improve their innovation and entrepreneurship capabilities.

Assumption 5: Digitalization of higher education promotes the improvement of college students' innovation and entrepreneurship abilities by enhancing the competence of innovation and entrepreneurship teachers. The higher the competence of innovation and entrepreneurship teachers, the easier it is for college students to improve their innovation and entrepreneurship abilities.

## 4 Analysis and Validation of the Model for Enhancing Innovation and Entrepreneurship Capabilities

### 4.1 Questionnaire Design and Distribution

Based on literature research and practical understanding, this article designed a survey questionnaire and distributed it to college students for investigation. The content of the survey questionnaire mainly includes: basic information of the sample, the use of digitalization by college students, different stages in the process of college students' innovation and entrepreneurship competitions, and the educational effect of college students' innovation and entrepreneurship competitions. The survey questionnaire is distributed online through Wenjuanxing. After the questionnaire was collected, a total of 202 valid questionnaires were obtained by excluding samples that were unqualified or had not participated in the competition. Perform descriptive analysis, correlation analysis, and regression analysis on the questionnaire data using Excel and SPSS statistical software.

### 4.2 Descriptive Analysis

#### 4.2.1 Descriptive Analysis of Basic Information

This survey obtained 202 valid questionnaires, and the basic information of the samples is presented in Table 1.

Table 1 Basic information of the sample

| Item   | Options           | Select times | Percentage |
|--------|-------------------|--------------|------------|
| Gender | male              | 83           | 40.49%     |
|        | female            | 122          | 59.51%     |
| Grade  | Freshman          | 42           | 20.49%     |
|        | Sophomore         | 38           | 18.54%     |
|        | Juniors           | 98           | 47.8%      |
|        | senior            | 18           | 8.78%      |
|        | Graduate students | 9            | 4.39%      |

Table 1 Basic information of the sample (Continued.)

| Item                                                                                     | Options                  | Select times | Percentage |
|------------------------------------------------------------------------------------------|--------------------------|--------------|------------|
| Professional Category                                                                    | Economics and management | 91           | 45.27%     |
|                                                                                          | Literature and history   | 16           | 7.96%      |
|                                                                                          | Science and engineering  | 81           | 40.30%     |
|                                                                                          | Arts                     | 4            | 1.99%      |
|                                                                                          | other                    | 9            | 4.48%      |
| Number of innovation and entrepreneurship competitions participated in                   | 1 time                   | 71           | 35.32%     |
|                                                                                          | 2 time                   | 58           | 28.86%     |
|                                                                                          | 3 time                   | 41           | 20.40%     |
|                                                                                          | 4 or more times          | 31           | 15.43%     |
| The number of awards won in innovation and entrepreneurship competitions participated in | 0 item                   | 84           | 41.79%     |
|                                                                                          | 1 item                   | 58           | 28.86%     |
|                                                                                          | 2 item                   | 31           | 15.42%     |
|                                                                                          | 3 item                   | 14           | 6.97%      |
|                                                                                          | 4 or more items          | 14           | 6.97%      |

#### 4.2.2 Descriptive Analysis of Motivations for Participating in Competitions

Descriptive statistical analysis was conducted on the motivations of college students participating in competitions. The results are presented in Figure 1: The primary motivations for college students to participate in competitions are personal growth, obtaining certificates to aid in future studies or employment, fulfilling graduation requirements through credit accumulation, and gaining points in comprehensive evaluations (listed in descending order of importance). Among these, personal growth was chosen by the largest number of participants, accounting for 64.7% of the total. On the other hand, the motivations of gaining a sense of accomplishment and earning respect from others were chosen by the fewest individuals, accounting for 29.4% of the total.

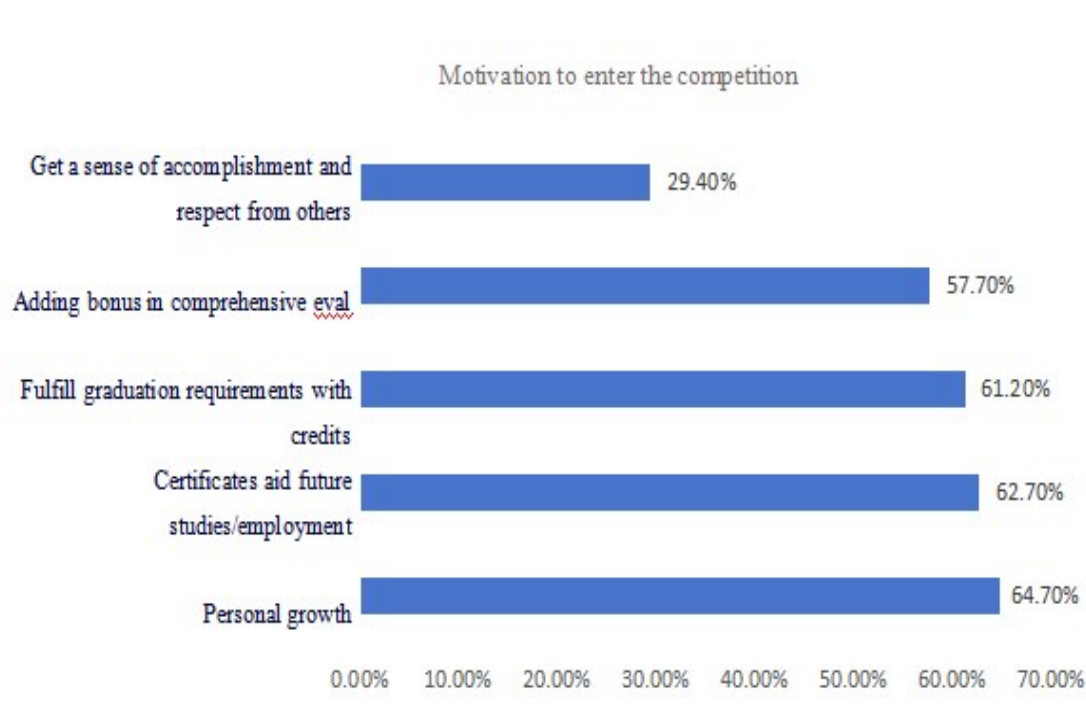


Figure 1 Motivation of College Students to Participate in Competitions

#### 4.2.3 Descriptive Analysis of Factors Influencing Competition Performance

Participants were asked to rate the importance of various factors in achieving good competition results on a scale of 1 to 5, with higher scores indicating greater importance. The results are shown in Figure 2: The highest score was for sufficient interaction between teachers and students (4.34), followed by the level of teacher guidance (4.28) and team strength (4.27). The organization and management level of the competition received a score of 3.95.

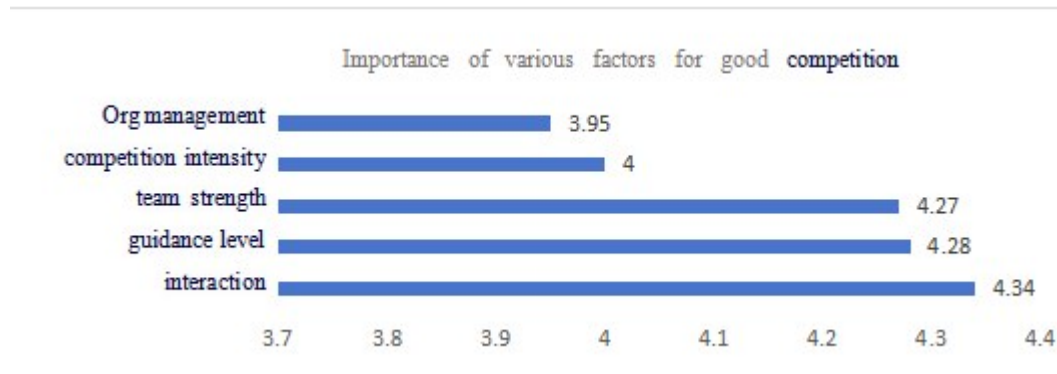


Figure 2 Factors' Importance in Winning Competitions

### 4.3 Correlation analysis

#### 4.3.1 Correlation analysis of related links and ability improvement effects

A correlation analysis was conducted on the ability to learn digital technology tools, the degree of digital technology consent, learning behavior performance, and the effectiveness of ability improvement. The analysis results shown in Table 2 indicate that the correlation coefficients are all above 0.85, indicating a significant positive relationship between the ability to learn digital technology and tools, the degree of digital technology consent, learning behavior performance, and the effectiveness of ability improvement.

Table 2 Relevant analysis of related links and the effectiveness of capability enhancement

|             |                                                   | Correlation Matrix                                |                                           |                                  |                            |
|-------------|---------------------------------------------------|---------------------------------------------------|-------------------------------------------|----------------------------------|----------------------------|
|             |                                                   | The ability to learn digital technology and tools | Degree of agreement on digital technology | Performance of learning behavior | Ability enhancement effect |
| correlation | The ability to learn digital technology and tools | 1.000                                             | 0.986                                     | 0.928                            | 0.988                      |
|             | Degree of agreement on digital technology         | 0.986                                             | 1.000                                     | 0.856                            | 0.970                      |
|             | Performance of learning behavior                  | 0.928                                             | 0.856                                     | 1.000                            | 0.915                      |
|             | Ability enhancement effect                        | 0.988                                             | 0.970                                     | 0.915                            | 1.000                      |

#### 4.3.2 Correlation analysis of education and attitudes towards educational activities in innovation and entrepreneurship

A correlation analysis was conducted on education and attitudes towards educational activities related to innovation and entrepreneurship. The analysis results are shown in Table 3, with a correlation coefficient of  $-0.02 < 0.1$ , indicating that there is no correlation between education in innovation and entrepreneurship and attitudes towards educational activities. and tools, the degree of digital technology consent, learning behavior performance, and the effectiveness of ability improvement.

Table 3 Relevant analysis of education and attitudes towards educational activities in innovation and entrepreneurship

|             |                                              | Correlation Matrix                           |                                         |
|-------------|----------------------------------------------|----------------------------------------------|-----------------------------------------|
|             |                                              | Education in innovation and entrepreneurship | Attitude towards educational activities |
| correlation | Education in innovation and entrepreneurship | 1.000                                        | -0.020                                  |
|             | Attitude towards educational activities      | -0.020                                       | 1.000                                   |

### 4.4 Regression analysis

#### 4.4.1 Regression analysis of the impact of digital capability enhancement on learning tools

Regression analysis was conducted with the improvement effect of digital capabilities as the independent variable and online platforms as the dependent variable, and the results are shown in Table 4 as shown, the standardized regression coefficient of the effect of digital ability improvement on online platforms is 0.976, with a significance  $p < 0.01$ , indicating that teacher-student interaction has a significant positive impact on creativity, that is, the higher the effect of digital ability improvement, the more frequently the online platform is used. Regression analysis was conducted with the effect

of digital capability improvement as the independent variable and online education as the dependent variable. The standard regression coefficient of the effect of digital capability improvement on online education was 0.998, with a significance  $p < 0.01$ , indicating that the effect of digital capability improvement has a significant positive impact on online education. That is, the higher the effect of digital capability improvement, the more frequently online platforms are used. Regression analysis was conducted with the effect of digital capability improvement as the independent variable and network collaboration tools as the dependent variable. The standardized regression coefficient of the effect of digital capability improvement on network collaboration tools was 0.974, with a significant  $p$ -value  $< 0.01$ , indicating that the effect of digital capability improvement has a significant positive impact on network collaboration tools. That is, the higher the effect of digital capability improvement, the more frequently network collaboration tools are used.

**Table 4** Regression analysis of the impact of digital capability enhancement on learning tools

| independent variable        | dependent variable          |                |                             |                |                             |                |
|-----------------------------|-----------------------------|----------------|-----------------------------|----------------|-----------------------------|----------------|
|                             | Online platform             |                | Online education            |                | Network collaboration tools |                |
|                             | Standardization coefficient | Significance p | Standardization coefficient | Significance p | Standardization coefficient | Significance p |
| Teacher student interaction | 0.976                       | 0.004          | 0.998                       | 0.000          | 0.974                       | 0.005          |
| $R^2$                       |                             | 0.953          |                             | 0.996          |                             | 0.948          |
| adjust $R^2$                |                             | 0.937          |                             | 0.994          |                             | 0.931          |
| Model $F$ -value            |                             | 60.40          |                             | 688.467        |                             | 54.664         |

#### 4.4.2 Regression analysis of the impact of digital capability enhancement on the degree of digital technology consent

Regression analysis was conducted with the effect of digital capability improvement as the independent variable and the degree of digital technology consent as the dependent variable. The results are shown in Table 5. The standardized regression coefficient of the effect of digital capability improvement on the degree of digital technology consent is 0.970, with a significant  $p$ -value  $< 0.01$ , indicating that the effect of digital capability improvement has a significant positive impact on the performance of digital technology consent. That is, the higher the effect of digital capability improvement, the higher the degree of digital technology consent.

**Table 5** Regression analysis of the impact of digital capability enhancement on the degree of digital technology consent

| independent variable                     | Dependent variable: Degree of digital technology consent |                |
|------------------------------------------|----------------------------------------------------------|----------------|
|                                          | Standardized Coefficient                                 | Significance p |
| Improvement effect of digital capability | 0.970                                                    | 0.006          |
| $R^2$                                    |                                                          | 0.941          |
| adjust $R^2$                             |                                                          | 0.921          |
| Model $F$ -value                         |                                                          | 47.932         |

#### 4.4.3 Regression analysis of the impact of digital ability enhancement on learning behavior performance

Regression analysis was conducted with the effect of digital ability improvement as the independent variable and learning behavior performance as the dependent variable. As shown in Table 6, the standardized regression coefficient of the effect of digital ability improvement on learning behavior performance is 0.915, with a significant  $p$ -value  $< 0.05$ , indicating that the effect of digital ability improvement has a significant positive impact on learning behavior performance. That is, the higher the effect of digital ability improvement, the better the learning behavior performance.

**Table 6** Regression analysis of the impact of digital ability enhancement on learning behavior performance

| independent variable                     | Dependent variable: Performance of learning behavior |                |
|------------------------------------------|------------------------------------------------------|----------------|
|                                          | Standardized Coefficient                             | Significance p |
| Improvement effect of digital capability | 0.915                                                | 0.029          |
| $R^2$                                    |                                                      | 0.837          |
| Adjust $R^2$                             |                                                      | 0.783          |
| Model $F$ -value                         |                                                      | 15.453         |

## **5 Countermeasures and Suggestions**

### **5.1 Strengthening the construction of digital teaching resources**

In the context of the current information age, universities should actively respond to the needs of the times and increase efforts in the construction of digital teaching resources. By integrating high-quality educational resources and developing more creative and practical online courses and virtual laboratories, we aim to provide college students with a comprehensive, systematic, and flexible knowledge system for innovation and entrepreneurship. These online courses can cover a comprehensive range of content from basic theories to practical operations, from market analysis to project management, helping students improve their ability to solve practical problems on the basis of mastering solid theories. At the same time, the introduction of virtual laboratories can simulate real entrepreneurial environments, allowing students to experience the entrepreneurial process in virtual spaces and accumulate valuable practical experience. This not only enriches the knowledge reserve of college students, but also lays a solid foundation for their future innovation and entrepreneurship.

### **5.2 Improve the digital teaching platform**

In order to further enhance the effectiveness of digital teaching, universities also need to continuously improve the functions and services of digital teaching platforms. The platform should have high usability and interactivity to ensure that students can easily get started and quickly integrate into the learning environment. By optimizing user interface design, providing personalized learning path recommendations, and real-time feedback mechanisms, students' learning motivation is enhanced. In addition, the platform should also support various forms of online communication, such as discussion forums, online meetings, etc., to create a convenient learning and communication environment for college students. This kind of interaction not only facilitates knowledge sharing and collision, but also cultivates students' teamwork and communication skills.

### **5.3 Promote resource sharing and collaboration**

In order to promote cooperation and resource integration among college students, universities should actively promote resource sharing and collaboration. By establishing a digital resource sharing platform and an innovation and entrepreneurship project collaboration platform, we can break down information silos and achieve maximum resource utilization. These platforms can provide students with one-stop services such as project display, team recruitment, and funding docking, promoting the incubation of creativity and the implementation of projects. At the same time, through cross school and cross disciplinary cooperation, students' innovative thinking is stimulated, their horizons are broadened, and new vitality is injected into innovation and entrepreneurship.

### **5.4 Enhance the level of innovation and entrepreneurship faculty**

Teachers are the guides and promoters of innovation and entrepreneurship education, and their teaching level and guidance ability directly affect the growth and development of students. Therefore, universities should strengthen the training and support of innovation and entrepreneurship teachers. By organizing regular teacher training, academic exchanges, practical inspections, and other activities, we aim to enhance teachers' professional competence and teaching skills. At the same time, encourage teachers to participate in innovation and entrepreneurship projects, accumulate practical experience, and improve their guidance abilities. In addition, establishing a scientific evaluation system and incentive mechanism can stimulate teachers' teaching enthusiasm and innovative spirit, providing better guidance and support for college students' innovation and entrepreneurship.

### **5.5 Strengthen policy guidance and support**

Government departments play an important role in innovation and entrepreneurship education in universities. In order to stimulate college students' enthusiasm for innovation and entrepreneurship, the government should strengthen policy guidance and support for innovation and entrepreneurship education in universities. Develop more favorable entrepreneurship policies and financial support measures, such as tax reductions, entrepreneurship subsidies, financing guarantees, etc., to lower the threshold and risks for students to start their own businesses. At the same time, establish innovation and entrepreneurship incubation bases and entrepreneurship mentor teams to provide students with comprehensive and multi-level entrepreneurship guidance and services. By implementing these policies, we can create a favorable atmosphere for innovation and entrepreneurship, stimulate students' entrepreneurial potential, and promote the sustainable development of innovation and entrepreneurship education in universities.

In the broad context of digital campus construction, the above five strategies have profound and significant implications for cultivating the innovation and entrepreneurship abilities of college students. They not only constitute the core elements of the innovation and entrepreneurship education ecosystem, but also the key driving force for promoting the leap in education quality and improving effectiveness. By strengthening the development of these key areas, we can lay a solid path for students to achieve future career success, ensuring that they can stand out with outstanding innovative thinking and practical abilities when facing the complex and ever-changing job market. In summary, the implementation of these strategies not only helps to enhance students' innovation and entrepreneurship abilities, but also points out the direction for the reform of innovation and entrepreneurship education in universities. They have jointly promoted the comprehensive improvement of innovation and entrepreneurship education in universities, and provided a continuous supply of high-quality talents for the country's innovation driven development strategy. In this process, we witnessed the profound connection and positive impact from individual growth to educational reform, and then to national development.

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