

The Influence of Digital Literacy on College Students' Entrepreneurial Opportunity Recognition: The Moderating Role of Innovation and Entrepreneurship Education

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Abstract: To explore the impact of digital literacy on college students' entrepreneurial opportunity recognition, this study conducted a questionnaire survey using the Digital Literacy Scale, the Entrepreneurial Opportunity Recognition Scale, and the Innovation and Entrepreneurship Education Scale. A total of 542 valid responses were collected. The results revealed a significant positive correlation between digital literacy and entrepreneurial opportunity recognition among college students ($\beta = 0.856, P < 0.01$). Further analysis indicated that innovation and entrepreneurship education plays a positive moderating role in this relationship ($\beta = 0.111, P < 0.01$). In other words, the higher the students' scores in innovation and entrepreneurship education, the stronger the relationship between digital literacy and their ability to recognize entrepreneurial opportunities.

Keywords: Digital literacy; College students; Entrepreneurial opportunity recognition; Innovation and entrepreneurship education; Talent cultivation; Innovation awareness

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1. Introduction

College student entrepreneurship plays a vital role in both individual career development and broader social progress. Against the backdrop of rapid advancements in internet technology and the digital economy, the ability to identify and seize entrepreneurial opportunities has become a core factor determining the success of student entrepreneurship. Recognizing entrepreneurial opportunities requires entrepreneurs to possess sharp market insight, innovative thinking, and sound decision-making abilities—areas in which digital literacy is particularly critical.

Digital literacy refers to an individual's ability to use digital technologies effectively, efficiently, and

securely, encompassing skills such as information acquisition, analysis, evaluation, and creation. Research shows that digital literacy significantly influences key factors such as self-efficacy, cognitive decision-making, and innovation performance ^[1,2]. However, existing studies on the specific relationship and underlying mechanisms between digital literacy and entrepreneurial opportunity recognition remain limited.

This study aims to explore the influence of digital literacy on college students' entrepreneurial opportunity recognition and to analyze the potential moderating role of innovation and entrepreneurship education. The goal is to provide recommendations for higher education institutions to enhance students' ability to recognize entrepreneurial opportunities.

2. Concept definitions and hypothesis

2.1. Digital literacy and entrepreneurial opportunity recognition among college students

In 1994, Israeli scholars first introduced the concept of digital literacy, breaking it down into five dimensions: re-creative literacy, visual literacy, branching literacy, information literacy, and emotional literacy ^[3]. Since 2006, Chinese scholars have actively studied digital literacy and generally agree that it encompasses not only the basic ability to apply digital technologies but also comprehensive skills and cultural competencies such as knowledge creation, sharing, and discernment.

Specifically for college students, digital literacy includes seven core elements: accurate recognition of digital information, acquisition of digital data, communication and exchange of information, data analysis and evaluation, protection of digital security, problem-solving in digital environments, and digital ethics and values ^[4]. Fang and He constructed a digital literacy framework for college students that consists of six dimensions—information and data, communication and collaboration, content and creation, digital life, learning, and development—covering 20 specific competencies ^[5].

Entrepreneurial opportunity recognition refers to the dynamic, continuously adaptive process through which entrepreneurs perceive, discover, evaluate, and develop business opportunities. It plays a critical role in bridging entrepreneurial intention and action. Research by Yu and colleagues found that self-efficacy, access to resources, and prior knowledge are positively correlated with opportunity recognition ^[6], with resource acquisition being a key factor linked to digital literacy among students. Peiris *et al.* and Wang proposed that factors influencing opportunity recognition include individual and environmental characteristics, resource accessibility, and social networks ^[7,8].

In the digital era, digital literacy has become a vital capability for individuals to access information, process data, and make decisions, all of which positively influence college students' ability to identify and seize entrepreneurial opportunities. According to Social Cognitive Theory, individual behavior, cognition, and environmental factors interact; thus, as a cognitive ability, digital literacy affects how opportunities are identified and evaluated ^[9]. Information Processing Theory suggests that individuals' ability to process information determines how they understand and respond to complex situations—students with higher digital literacy are more adept at recognizing potential business opportunities.

Studies have shown that students with strong digital skills perform better in entrepreneurial simulation activities, and digital skills are considered a key dimension of digital literacy. Research by Deci and Ryan indicates that an individual's technical proficiency is positively associated with their willingness to adopt and utilize new technologies—an association applicable to entrepreneurial opportunity recognition ^[10].

Based on this, the following hypothesis is proposed:

Hypothesis H₁: College students' digital literacy has a positive impact on their entrepreneurial opportunity recognition.

2.2. The moderating role of innovation and entrepreneurship education

Innovation and entrepreneurship education not only cultivates students' innovative thinking and entrepreneurial spirit but also enhances their practical skills. According to a survey conducted among higher education institutions, students who participated in innovation and entrepreneurship education programs scored 35% higher in innovative thinking and entrepreneurial spirit, and 27% higher in practical skills compared to those who did not participate ^[11]. These findings indicate that innovation and entrepreneurship education has a significant positive impact on the development of students' innovation capabilities.

According to Self-Determination Theory, when education satisfies students' needs for autonomy, competence, and relatedness, their intrinsic motivation can be effectively stimulated. A cross-disciplinary meta-analysis found a positive correlation ($r = 0.65$) between the fulfillment of these basic psychological needs and students' intrinsic motivation ^[12]. The enhancement of motivation not only facilitates further development of digital literacy but also improves the ability to recognize entrepreneurial opportunities.

Based on this, the following hypothesis is proposed:

Hypothesis H₂: Innovation and entrepreneurship education positively moderates the relationship between college students' digital literacy and entrepreneurial opportunity recognition.

3. Research subjects and methods

3.1. Subjects

This study used the Wenjuanxing platform, a Chinese questionnaire website, to design, distribute, and collect questionnaires, gathering a total of 548 responses. After strict screening, 6 invalid questionnaires were excluded, resulting in 542 valid questionnaires, with an effective response rate of 98.90%. Among the valid samples, there were 251 males (46.3%) and 291 females (53.7%). Regarding age composition, 186 respondents are under 22 years old, 212 are between 22 and 25 years old, 57 are between 26 and 28 years old, 72 are between 29 and 34 years old, and 15 are 35 years or older. In terms of educational background, 311 have a bachelor's degree (57.4%), 217 have a master's degree (40.0%), and 14 have other qualifications (2.6%). Regarding household income, 33 people have a monthly income below 10,000 yuan (6.1%), 107 between 10,000 and 30,000 yuan (19.7%), 135 between 30,000 and 50,000 yuan (24.9%), and 267 above 50,000 yuan (49.3%).

3.2. Instruments

The scales used in this study are shown in **Table 1**. Based on relevant research, demographic variables included gender, age, household income, education level, and whether relatives or friends have entrepreneurial experience. Additionally, to examine the impact of motivation on college students' entrepreneurial opportunity recognition, two items were specifically added: "I desire to realize my life's value" and "I strongly want to make a greater contribution to economic and social development." Among the measurement tools used in this study, the Cronbach's alpha coefficients are as follows: college students' digital literacy ^[5] 0.97, innovation and entrepreneurship education ^[13] 0.93, and entrepreneurial opportunity recognition ^[11] 0.92.

3.3. Statistical analysis

This study used SPSS 25.0 software for data analysis, mainly including descriptive statistics, Pearson correlation

analysis, and multiple regression analysis to evaluate the relationships among college students' digital literacy, entrepreneurial opportunity recognition, and innovation and entrepreneurship education.

4. Research findings and statistical analysis

4.1. Descriptive statistics and univariate analysis of college students' entrepreneurial opportunity recognition

In the study sample, the scores for college students' entrepreneurial opportunity recognition ranged from 3.37 to 4.72. Male students scored higher than female students. The effect of students' age on entrepreneurial opportunity recognition was relatively small. Students from average-income families showed little difference compared to those from low-income families. Students with a strong desire to realize their life value scored higher than those with moderate or general levels of desire. Students with a low desire to make greater contributions to economic and social development scored lower, while those with moderate to high desires scored higher and similarly among each other. Students who had relatives or friends with entrepreneurial experience scored higher than those who did not.

Analysis of variance showed that differences in entrepreneurial opportunity recognition among students by age, family income, desire to realize life value, education level, desire to contribute to economic and social development, and whether they had entrepreneurial relatives or friends were statistically significant ($P < 0.05$). Students aged 23 to 34 had the highest awareness of entrepreneurial opportunity recognition. The stronger the desire to realize life value and to contribute to economic and social development, the higher the level of entrepreneurial opportunity recognition. Additionally, students with entrepreneurial relatives or friends showed relatively higher levels of entrepreneurial opportunity recognition.

4.2. Correlation analysis of college students' digital literacy, entrepreneurial opportunity recognition, and innovation and entrepreneurship education

Using entrepreneurial opportunity recognition as the dependent variable, gender, age, education level, desire to realize life value, and desire to make greater contributions to economic and social development as control variables, and college students' digital literacy as the independent variable, Model 3 in **Table 1** shows that college students' digital literacy is significantly positively correlated with entrepreneurial opportunity recognition ($\beta = 0.824$, $P < 0.01$). Therefore, hypothesis H_1 is supported.

Table 1. Results of hierarchical regression analysis

Variables	Innovation and entrepreneurship education		Entrepreneurial opportunity recognition		
	Model 1	Model 2	Model 3	Model 4	Model 5
Control variables					
Gender	-0.009	-0.009	-0.005	-0.005	0.003
Age	0.051	0.005	0.089**	0.043	0.045
Education level	0.113	0.040	0.103*	0.029	-0.007
Desire to realize life value	0.306	-0.010	0.290**	-0.029	-0.008
Desire to make a greater contribution to economic and social development	0.479	0.083	0.440**	0.041	0.011

Table 1 (Continued)

Variables	Innovation and entrepreneurship education		Entrepreneurial opportunity recognition		
	Model 1	Model 2	Model 3	Model 4	Model 5
Independent variable					
College students' digital literacy		0.818**	0.824**	0.380**	0.451**
Moderating variables					
Innovation and entrepreneurship education				0.542**	0.555**
Digital literacy \times innovation and entrepreneurship education					0.673**
R^2	0.047**	0.628**	0.082**	0.793**	0.800**
ΔR^2	0.047**	0.586**	0.072**	0.704**	0.779**
F	4.362**	129.152**	7.832**	181.474**	235.093**
ΔF	4.362**	836.260**	7.832**	1122.91**	178.972**

4.3. Moderating effect test

To verify hypothesis H₂, this study employed a three-step hierarchical regression analysis and used the interaction term between variables to test the moderating effect of innovation and entrepreneurship education. Entrepreneurial opportunity recognition was set as the dependent variable, with control variables, college students' digital literacy, innovation and entrepreneurship education, and their interaction term introduced sequentially. The interaction between college students' digital literacy and innovation and entrepreneurship education was significant, indicating that innovation and entrepreneurship education positively moderates the effect of digital literacy on entrepreneurial opportunity recognition. Therefore, hypothesis H₂ is supported. The moderation effect is illustrated in **Figure 1**.

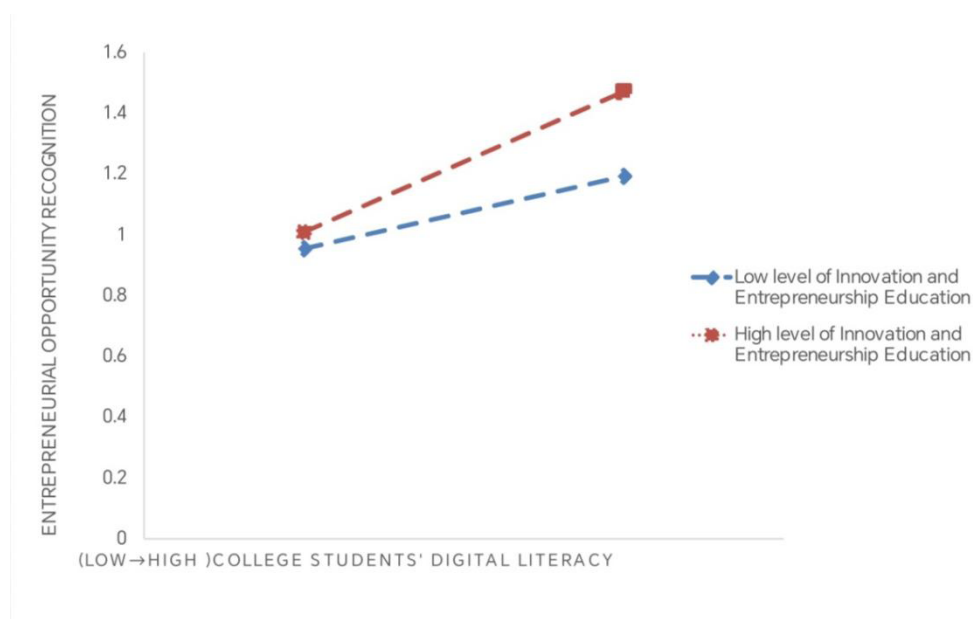


Figure 1. The moderating effect of innovation and entrepreneurship education on college students' digital literacy and entrepreneurial opportunity recognition

5. Conclusion

Digital literacy has a significant positive impact on college students' entrepreneurial opportunity recognition ($\beta = 0.824, P < 0.01$), and innovation and entrepreneurship education plays a positive moderating role in this relationship ($\beta = 0.111, P < 0.01$). Universities should emphasize the education of digital literacy among students and integrate it into the innovation and entrepreneurship education system, enhancing digital literacy through relevant courses and practical activities. At the same time, a comprehensive innovation and entrepreneurship education system should be established to strengthen the combination of theory and practice and improve the ability to recognize entrepreneurial opportunities. Additionally, attention should be paid to students' entrepreneurial motivations; educational interventions can be used to enhance achievement motivation and social responsibility motivation, thereby stimulating entrepreneurial passion. The results of this study provide valuable references for innovation and entrepreneurship education in universities, but also have limitations. The research sample is limited to college students, and future studies can expand to broader populations. The research method mainly relies on questionnaires, and future research could incorporate interviews and case analyses to explore the process and influencing factors of entrepreneurial opportunity recognition more deeply.

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Disclosure statement

The authors declare no conflict of interest.

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