

The Impact of University Innovation and Entrepreneurship Education on Entrepreneurial Intentions in the Context of Big Data: The Indirect Role of Entrepreneurial Self-efficacy

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Abstract

This study primarily investigates the impact of innovation and entrepreneurship education (IEE) on entrepreneurial intentions (EI) in the Context of Big Data. The survey targets full-time undergraduate students majoring in E-commerce at Chinese universities. A detailed analysis was conducted through confirmatory factor analysis, correlation analysis, and other methods. The research results indicate that IEE significantly positively affects EI and entrepreneurial self-efficacy (ESE). ESE significantly positively affects EI and mediates the impact of IEE on EI. This study delves deeply into these findings, in the context of big data, data analysis integrates into IEE to improve the entrepreneurial skills and knowledge of e-commerce students, and further enhance their entrepreneurial intentions through data-driven insight, provide advice for future research.

Keywords: Innovation and entrepreneurship education, entrepreneurial self-efficacy, entrepreneurial intentions, big data.

1. Introduction

As China's economy transitions into a new phase, global economic development is undergoing a transition period, and the socio-economic downward pressure is increasing. Entrepreneurship is widely recognized as a crucial economic driver for nations, generating new job opportunities and fostering innovation and competitiveness in the labor market [1]. In the realm of promoting innovation and entrepreneurship among college students, education plays a crucial role. Integrating education in these domains is vital for cultivating entrepreneurial drive and behavior among young people [2]. College students' significant role in stimulating economic development through entrepreneurial activities is also highlighted [3]. These perspectives underscore the importance of structured educational programs and supportive environments in nurturing entrepreneurial energy and capabilities among students. Empirical studies have shown that entrepreneurship education enables students to identify opportunities and start new businesses, which can help them embark on the path to becoming entrepreneurs [4]. Students' new behaviors, knowledge, abilities, skills, and techniques learned during their studies influence their EI [5]. College students have a better chance of success in entrepreneurship, and the possibilities for the growth of businesses have also improved [6]. College student entrepreneurship has emerged as a powerful force for advancing socioeconomic development [7]. This is because it can translate knowledge into societal value. Moreover, graduates must shift from seeking employment to creating employment opportunities. This is because the government of a country cannot guarantee that there will be sufficient job opportunities for all graduates of higher education [8]. Hence, there is significant theoretical and practical value in conducting thorough research on how university education in innovation and entrepreneurship influences individuals' intentions to pursue entrepreneurial endeavors.

In university entrepreneurship, ESE and IEE are considered two key drivers. Scholars have yet to agree on ESE's crucial role in influencing IEE. Self-efficacy (SE) is a person's belief in their capacity to carry out particular tasks, significantly impacting their behavioral choices. By empirically investigating how university IEE raises students' ESE and subsequently affects their EI, this study seeks to close this research gap.

Data from the 2023 "Two Sessions" show that the number of college graduates in China will reach 11.58 million, a record high after surpassing 10 million for the first time last year, an increase of 820,000 year-on-year, indicating that competition in the job market will become more intense. In response to the severe employment situation, enhancing college students' innovation and entrepreneurship capabilities has become a means to alleviate employment pressure [9]. The data show that the proportion of graduates receiving job offers among junior college, master's, and doctoral graduates is 54.4% and 56.7%, respectively, 4% and 6.3% higher than the overall average. However, the proportion of undergraduate job seekers receiving job offers is 47.5%, 2.9% lower than the overall average. According to the "2023 China New Flexible Employment Report," the drivers of new platforms include shared trips, self-media, platform live streaming, platform micro-business, and platform E-commerce [10]. In the context of the internet, the application of big data and artificial intelligence technologies has not only improved the operational efficiency of E-commerce but also brought more opportunities for innovation and entrepreneurship. The development of the E-commerce industry has also raised higher requirements for innovation and entrepreneurship education for E-commerce students. Applying technologies and concepts such as big data analytics, artificial intelligence, blockchain technology, and virtual reality in the E-commerce industry has become increasingly widespread. Students must learn and master these technologies promptly to lay a foundation for future innovation and entrepreneurship.

This study targets full-time undergraduate E-commerce students from Chinese universities. It aims to investigate how IEE affects their EI and examine the indirect impact of ESE. The study employs Structural Equation Modeling (SEM) to examine the associations between IEE, ESE, and EI in undergraduate E-commerce students. The research aims to explore the mechanisms and interactions involved in these relationships thoroughly. The objective is to provide theoretical insights and practical guidance to enhance the entrepreneurial aspirations of undergraduate E-commerce students, promoting their personal growth and contributing to sustainable progress in the E-commerce industry by nurturing innovative individuals suited to the modern era.

2. Literature Review

2.1 Innovation and entrepreneurship education

IEE represents a higher level of integration than separate innovation education and entrepreneurship education. It embodies a new teaching model and concept designed to address national and societal needs by nurturing entrepreneurial awareness and fostering innovative talents. University IEE, through student participation, explores enhanced entrepreneurial emotional cognition, increased resource allocation, and personalized educational models tailored to individual student characteristics [11]. Practical education in this field enhances students' creative thinking, problem-solving abilities, and capacity to establish businesses or create jobs, emphasizing quality and career orientation [12]. The strategic importance of IEE lies in cultivating innovative talents and establishing a comprehensive national framework for talent development [13]. Integrating IEE into university talent development goals can enhance students' employability through comprehensive engagement, faculty development, internal management improvements, environmental optimization, and university-industry collaboration [14]. Integrating entrepreneurship education with the essence of innovation education achieves significantly enhanced outcomes beyond initial expectations, highlighting its synergistic benefits [15]. "IEE" is a novel educational approach to nurturing students' innovative spirit and entrepreneurial mindset [16]. The primary objective of education in innovation and entrepreneurship is to improve students' qualities, ways of thinking, and skills, emphasizing a "dual creation" approach [17]. It is incorrect to see "IEE" as a simple combination of "innovation education" and "entrepreneurship education" [18]. Through higher education studies in entrepreneurship, this education improves students' entrepreneurial activities and fundamental entrepreneurial knowledge, strengthening cognitive and non-cognitive talents [19,20]. For students, entrepreneurship education is essential. Therefore, enhancing college students' innovative spirit, entrepreneurial awareness, and capacities is the goal of IEE. This is accomplished through development that is driven by innovation.

2.2 Entrepreneurial self-efficacy

"SE" was introduced as an individual's self-assessment of their capability to perform specific behaviors [21]. In organizational research, SE has been extensively studied [21-23], commonly described as "an individual's belief in their ability under conditions requiring specific motivation" [24,25].

The research underscores that SE significantly influences human actions, with individuals possessing high SE more likely to persist in pursuing their goals [21]. SE focuses on individuals' confidence in accomplishing specific behaviors [26]. Based on Bandura's theory, ESE is defined as the confidence and determination of college students aspiring to or engaging in entrepreneurship to achieve their objectives [27]. A preliminary model of ESE developed through grounded theory highlights factors such as individuals' effort, ability, perception, and control over their environment and actions [28]. "ESE" is described as "the strength of an individual's belief in their ability to perform entrepreneurial roles and tasks" successfully [29]. ESE relates to confidence, resilience, and persistence in overcoming initial challenges during the startup phase. Entrepreneurs with solid confidence in their abilities to execute tasks and launch new ventures tend to achieve more favorable outcomes [30,31].

2.3 Entrepreneurial intentions

When entrepreneurs shift their attention, experience, and actions from business awareness, business organizations' subsequent forms, and directions—such as survival, development, growth, and change—are based on this awareness and EI [32]. Intention models are more effective in predicting behavior than individual or environmental variables; therefore, studying individuals' EI is paramount [33]. EI is defined as a preference for entrepreneurship [34]. EI is subjective psychological readiness and level for new entrepreneurial activities [35]. Entrepreneurship is characterized by the appraisal of an individual's attitude and ability toward entrepreneurial behavior [36]. EI is the cognitive response of individuals to starting new enterprises. These intentions represent the mental framework through which individuals plan to realize new businesses [37]. Emotional intelligence is "the intention of a person to establish a new enterprise and consciously plan to do so at some point in the future" [38]. For a considerable amount of time, the "intentionality" of entrepreneurs has been regarded as a significant variable in establishing new businesses [38,39]. Numerous research has provided additional evidence that supports the validity of intentions in predicting actual behavior. In their study, it was highlighted that "most entrepreneurial activities are planned behaviors." The ambition to own or start a firm is the most common definition of plans to engage in entrepreneurial activity [33]. Therefore, entrepreneurial intent plays a vital role in an individual's decision to establish a new business and is considered the best predictor of entrepreneurial behavior [32,33,40-43]. Based on evidence predicting future entrepreneurial activities, even over a long period, EI has consistently represented a relevant construct in entrepreneurial research [44]. Consequently, more research focuses on college students' EI [45-47]. In summary, EI is the decisive factor in individual entrepreneurial behavior, with individuals' actual behavior determined by their behavioral intentions [48]. Behavioral intentions are the most reliable antecedents in predicting actual behavior.

2.4 Hypothesis model

This study investigates the interactions between IEE, ESE, and EI among undergraduate E-commerce students. Based on existing research and theory, four hypotheses are proposed to elucidate these relationships:

2.4.1 Innovation and entrepreneurship education and entrepreneurial intentions

Studies regularly demonstrate the significant influence that innovation and entrepreneurship-focused courses have on students' desire to pursue entrepreneurship. These courses significantly impact students' aspirations to start their businesses [49]. Empirical data supports entrepreneurship education's positive impact on encouraging entrepreneurial ambitions [50]. Similar findings were observed in a study of 25 universities across the country, which found a strong link between the development of entrepreneurial intent and innovation and entrepreneurship courses [51]. Several research support this relationship, showing that students' propensity for entrepreneurship is significantly increased by entrepreneurship education [52,53]. Thus, this research postulates:

H1: IEE has a significant positive impact on EI.

2.4.2 Innovation and entrepreneurship education and entrepreneurial self-efficacy

Individuals' educational attainment is linked to different degrees of ESE [29]. In entrepreneurship intention research, it was found that students' levels of ESE were significantly higher following entrepreneurship education than before the instruction [54]. The significance of entrepreneurship education is demonstrated by the fact that students' confidence in their capacity to succeed as entrepreneurs is significantly increased when they participate in hands-on entrepreneurship education activities.

This study puts out the following hypothesis in light of the debates above:

H2: IEE has a significant positive impact on ESE.

2.4.3 Entrepreneurial self-efficacy and entrepreneurial intentions

The concept of "ESE" refers to the extent to which people believe they can start a firm, exercise entrepreneurial skills, and achieve their goals. The impact of ESE on EI and their interaction was thoroughly analyzed, with two cross-cultural sample studies conducted to account for cultural differences [55]. Managers from the same nations made up sample 2, whereas students from particular business schools in the US and South Korea made up sample 1. The study's findings showed a strong positive correlation between the two factors, suggesting that ESE positively influences the desire to become an entrepreneur. A model of ESE was developed based on the roles that entrepreneurs perform through a series of empirical studies [36]. This model empirically confirmed the favorable correlation between individual entrepreneurial aspirations and ESE. Data collected from many Omani higher education institutions showed that entrepreneurship education enhanced students' perceived levels of SE, thereby increasing their intent to pursue entrepreneurial endeavors [56]. Using a sample survey, it was discovered that ESE significantly and positively impacts both entrepreneurship and emotional intelligence [57]. Thus, this research postulates:

H3: ESE has a significant positive impact on EI.

2.4.4 The intermediary role of entrepreneurial self-efficacy

It was first proposed that ESE indirectly influences the formation of EI [58]. A questionnaire investigated the relationship between college students and personality factors. It was suggested that plans to become entrepreneurs among college students are significantly influenced by the Big Five personality traits and ESE, with ESE having a more substantial but indirect effect [59]. A survey using samples of university students in Tianjin explored the impact of ESE on EI and the influence of achievement motivation on EI. It was found that ESE plays a partially indirect role and has specific indirect effects [60]. Thus, the following hypothesis is put out by this study:

H4: ESE is an intermediary in the relationship between IEE and EI.

3. Methods

3.1 Instruments

This study uses a quantitative methodology, with the primary means of gathering data being a survey questionnaire. The scale for IEE comprises six items, with three questions on entrepreneurial knowledge learning, three on innovation and entrepreneurship practices, and one on entrepreneurial mentorship. The ESE scale consists of 6 items. The entrepreneurial intention scale includes four items: two on entrepreneurial readiness and two on entrepreneurial interest. Responses are assessed using a 5-point Likert scale from "strongly disagree" to "strongly agree," with scores ranging from 1 to 5, respectively.

3.2 Participants and procedures

According to Cochran's sample size calculation, this study requires 539 questionnaires. A total of 539 questionnaires were distributed both online and offline, with 500 retrieved [61]. After excluding invalid responses, the valid research sample totaled 486 participants, resulting in a valid questionnaire retrieval rate of 90.17%.

3.3 Data analysis

Descriptive analysis was first performed to ascertain whether the data in this study satisfied the requirements for factor analysis, followed by exploratory factor analysis. The KMO value must be more than 0.7, and Bartlett's test of sphericity significance must be less than 0.05 for the data to meet both requirements. The observed variables show significant correlations and are appropriate for factor analysis if these requirements are satisfied [62]. Third, convergent validity was assessed using confirmatory factor analysis, which mainly looked at whether all standardized factor loading was more than 0.5, composite reliability (CR) was more than 0.6, and average variance extracted (AVE) was more than 0.5. Lastly, structural equation modeling (SEM) and correlation investigations were carried out.

4. Results

4.1 Demographic analysis

As shown in Table 1, 48.4% of the participants were female (235), and 51.6% were male (251). This indicates a relatively balanced gender distribution among the respondents. Most participants (66.7%) were from ordinary undergraduate institutions (324). The year-level distribution was fairly even: 24.7% in the first year (120), 25.7% in the second year (125), 24.1% in the third year (117), and 25.5% in the fourth year (124). This broad distribution across different year levels supports a comprehensive analysis of the overall effects.

Table 1 Frequency analysis of basic information.

Item	Indicators	Frequency	Percent%
Gender	Male	251	51.6
	Female	235	48.4
School Level	Double first-class	162	33.3
	Ordinary undergraduate	324	66.7
Grade Level	Grade 1	120	24.7
	Grade 2	125	25.7
	Grade 3	117	24.1
	Grade 4	124	25.5
	Total	486	100

4.2 Reliability and validity analysis

The reliability analysis showed that the Cronbach's alpha for IEE, ESE, and EI were 0.894, 0.860, and 0.862, respectively, with an overall reliability of 0.896, indicating good reliability of the questionnaire [63].

In the validity analysis, the overall data KMO was 0.917, with a chi-square value of 4000.431, degrees of freedom of 136, and $p < 0.001$, confirming high validity and suitability for effective analysis [64].

This study only included undergraduate students studying E-commerce, so looking for any potential common technique bias was important. According to the Harman single-factor test findings, there was no standard method bias because the first factor's cumulative variance was 37.693%, less than 50% [65].

Overall, the reliability and validity of the questionnaire data met the general acceptance standards for social science research, and no common method bias was detected, allowing for practical analysis.

4.3 Correlation analysis

As shown in Table 2, the correlation coefficients for ESE, IEE, and EI were 0.363, 0.456, and 0.5, respectively, with corresponding p-values all less than 0.001, indicating significant statistical significance and showing significant correlations among IEE, ESE, and EI.

Table 2 Correlation analysis.

	IEE	ESE	EI
IEE	1		
ESE	0.363***	1	
EI	0.456***	0.5***	1

Note: *** $p < 0.001$ (two-tailed); $n=486$.

4.4 Path analysis

The structural equation modeling results in Table 3 show that IEE has a direct effect on EI, IEE has a direct impact on ESE, and ESE has a direct effect on EI, all with statistical significance. Hypotheses 1, 2, and 3 are accepted.

Table 3 Direct path coefficient.

Hypothesis	Path	Coefficient	S.E.	C.R.	p	Test results
H1	EI←IEE	0.367	0.054	6.76	***	Accepted
H2	ESE←IEE	0.445	0.059	7.515	***	Accepted
H3	EI←ESE	0.37	0.058	6.355	***	Accepted

Note: ***p < 0.001 (two-tailed); n=486.

4.5 Indirect effects analysis

To study the indirect impact of ESE, this research applied the Bootstrap technique, expanding the sample size to 5000 with a 95% confidence interval and repeated sampling analysis [66].

Table 4 Standardized the hypothesized model's direct, indirect, and total effects.

variables	Point estimate	Product of coefficients		Bootstrapping			
				Percentile 99% CI		Bias-corrected percentile 99% CI	
		SE	Z	Lower	Upper	Lower	Upper
Standardized total effects							
IEE→EI	0.456	0.048	9.5	0.360	0.548	0.361	0.549
Standardized direct effects							
IEE→EI	0.316	0.054	5.852	0.548	0.548	0.211	0.211
Standardized indirect effects							
IEE→EI	0.140	0.027	5.185	0.093	0.201	0.211	0.199

Note: Standardized estimating of 5000 bootstrap sample.

As shown in Table 4, $Z > 1.96$, and the confidence intervals for all variables did not include 0 (Hayes, 2012). The Bootstrap test results confirmed the indirect effect of ESE (standardized indirect effect = 0.140), thus supporting Hypothesis 4.

5. Discussion

The results of this study indicate that IEE has a considerable positive influence on EI, as evidenced by a path coefficient of 0.367. Empirical evidence confirms that IEE significantly impacts EI [67]. Based on the experimental study, Engaging in entrepreneurship education courses and training considerably impacts students' entrepreneurial inclinations [68]. The path coefficient between IEE and ESE is 0.445, suggesting a substantial and favorable influence of IEE on ESE. Furthermore, IEE enables students to gain comprehensive knowledge and skills necessary for entrepreneurship while strengthening their belief in their ability to succeed as entrepreneurs [69]. Previous research partially supports this study. IEE often involves teaching entrepreneurial information, training skills, and facilitating practical activities [29]. This equips students to handle obstacles that arise during the entrepreneurial process effectively. The acquisition of knowledge and skills improves students' belief in their ability to succeed as entrepreneurs. Nevertheless, this outcome diverges from specific prior scholarly works. Conventional ways of teaching entrepreneurship may not effectively improve students' belief in their ability to succeed as entrepreneurs [70]. They suggested that more participatory and immersive teaching techniques should be used instead. The path correlation between ESE and EI is 0.37, suggesting ESE's substantial and favorable influence on EI. Previous research partially supports the findings of this study. Individuals with a high level of SE are more inclined to engage in particular entrepreneurial acts rather than remain at the mere intention stage [71]. This self-assurance motivates them to strategize and actively implement entrepreneurial initiatives. ESE, which refers to individuals' confidence to execute entrepreneurial endeavors effectively, substantially impacts

entrepreneurial aspirations. Studies indicate that persons with higher levels of SE are more inclined to develop and maintain entrepreneurial ambitions. These studies also determined a substantial correlation between ESE and EI [72].

ESE acts as a mediator between IEE and EI. This finding aligns with prior research. It was discovered that IEE positively impacted students' entrepreneurial knowledge and skills. This, in turn, increased their confidence and capacity to handle entrepreneurial issues, ultimately improving their ESE [73]. This sense of self-confidence and belief in one's abilities further encourages the development and reinforcement of intentions to become an entrepreneur. It was validated that ESE is mediating, indicating that IEE initially positively impacts SE, enhancing EI [69].

6. Conclusion

This research found that the four hypotheses proposed in the study are accepted by the information included: the IEE positively impacts EI and ESE, and ESE impacts EI, concluding that IEE plays a crucial role in improving students' ESE and EI.

The study found that the innovation and entrepreneurship curriculum system for E-commerce students needs improvement, especially in the era of big data, entrepreneurship courses in colleges and universities should keep pace with The Times, design targeted entrepreneurship courses to effectively enhance students' EI, add entrepreneurship courses focused on big data analytics and other technologies, and there is a need to improve professional faculty and increase targeted entrepreneurial practices for E-commerce majors, such as establishing E-commerce practice bases, organizing electronic sandbox competitions, and E-commerce contests to enhance students' ESE and EI better. The education provided by professional teachers can inspire and influence students' entrepreneurial intentions. Through entrepreneurial practice, students can experience the entrepreneurial atmosphere, enhance their entrepreneurial confidence, and have clear entrepreneurial goals, which can help improve their entrepreneurial intentions to a certain extent. The government should formulate policies and systems for related professional fields by layers and categories to enhance E-commerce students' EI, thereby continuously creating more job opportunities.

Additionally, ESE significantly mediates the relationship between IEE and EI. Therefore, the conclusion is that exposure to entrepreneurial spirit will help students create stronger ESE, thereby positively influencing EI. The students' ability to identify opportunities, innovate, and tolerate risk will all impact their entrepreneurial intentions. Therefore, higher education must enhance these abilities through quality IEE, increasing their EI.

In conclusion, universities should strengthen theoretical and practical education in innovation and entrepreneurship, which is more suitable for improving E-commerce students' EI. Despite addressing all research objectives, this study has some theoretical, methodological, and sample limitations. Future research should combine quantitative and qualitative methods for deeper insights. Other variables, such as entrepreneurial spirit and environment, could also be included and explored as mediators. Furthermore, exploring stratified sampling could promote comparative studies among different groups or departments.

Acknowledgment

This academic article is by a graduate student in the Doctor of Philosophy program in management at Chakrabongse Bhuvanarth International Institute for Interdisciplinary Studies (CBIS), Rajamangala University of Technology, Tawan-OK, Thailand. The researcher would like to thank all cited experts for contributing to this research..

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