

THE MEDIATING ROLE OF LEARNER AUTONOMY BETWEEN ENTREPRENEURIAL EDUCATION AND ENTREPRENEURIAL SUCCESS

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ABSTRACT

The paper examines how learner autonomy bridges entrepreneurial education and success. Using theories like TPB, Human Value Theory, and Autonomous Learning Theory, it explains that entrepreneurial education boosts success via autonomous learning. TPB guides entrepreneurial aspirations, while Human Value Theory highlights self-directed learning and adaptability. Autonomous Learning Theory's principles are vital for promoting self-control and autonomous learning in entrepreneurship.

This study employed quantitative and retrospective methods to gather data from alumna entrepreneurs who have participated in entrepreneurial education programs and asked them to recall the influence of entrepreneurial education on their current achievements. It investigated whether learner autonomy acts as a bridge between entrepreneurial education and entrepreneurial success, using mediation analysis. Results showed that entrepreneurial education positively affected entrepreneurial success, but autonomy strengthened this link, functioning partially as a mediator. These outcomes are significant for theories on entrepreneurial behavior and autonomous learning, as well as for guiding educators and policymakers in nurturing entrepreneurial education.

Keywords: Learner Autonomy, Entrepreneurial Education, Entrepreneurial Success, Autonomous Learning.

INTRODUCTION

Micro, small, and medium enterprises (MSMEs) account for more than 90% of private enterprises in developing countries, providing 60% of total employment and contributing up to 40% of GDP (Bashir, 2020; Nungsari et al., 2023). MSMEs are crucial for economic development, employment generation, and poverty alleviation (Obschonka et al., 2017). As a result, many countries are focusing on entrepreneurship to foster the expansion and standardization of MSMEs (Nungsari et al., 2023). Entrepreneurship is believed to be a key driver of economic development and growth (Obschonka et al., 2017; Shir et al., 2018), and policymakers are encouraging entrepreneurial behavior among youth to attain financial, cultural, and social advantages (Ho et al., 2018; Santika et al., 2022). Accordingly, entrepreneurial education has emerged as a way to prepare the future workforce for success through creativity, innovation, and entrepreneurial mindset cultivation (Munawar et al., 2023).

Background

Entrepreneurial education (EE) is highly valued worldwide, with governments believing it can promote entrepreneurship (Nungsari et al., 2023). Consequently, EE programs in higher institutions have rapidly expanded within higher education systems globally (Cui&Bell, 2022). The Global Entrepreneurship Monitor (2021) emphasizes that

entrepreneurial education instills an entrepreneurial mindset, preparing individuals with skills like creativity, leadership, and problem-solving (Banha et al., 2022). It equips students for future economic uncertainties, making entrepreneurial education crucial for both personal and societal growth (Newman et al.). In 1989, UNESCO's International Symposium on Education for the 21st Century highlighted entrepreneurship education as essential for fostering innovation and risk-taking in business (Ratten & Usmanij, 2021). The European Commission has also prioritized entrepreneurship education to build a sustainable European economy and society.

Problem Statement

China's push for entrepreneurship aligns with global trends, prompting universities to integrate entrepreneurial education within the 'mass entrepreneurship and innovation' initiative. The government's leadership and financial backing for these programs aim to foster skills and encourage students to start businesses (Ahmed et al., 2020; Jun Cui, 2021; Chien et al., 2020). Despite a steady rise in students' entrepreneurial interest, with 96.1% expressing intention in 2021 (Mao, 2021), the actual startup rate was only 13.2% in 2023 (Zhilianzhaopin, 2023), indicating a gap between intention and action. This prompts questions about factors hindering progress and the role of entrepreneurial education in bridging this gap, particularly in enhancing beneficial factors such as learner autonomy for improved entrepreneurial success.

RESEARCH QUESTIONS, OBJECTIVES AND HYPOTHESES

This paper proposes three research questions, three objectives, and four hypotheses. The questions focus on the impact of entrepreneurial education and learner autonomy on success. Objectives aim to understand the connections between entrepreneurial education (EE), learner autonomy and entrepreneurial success (ES), and the hypotheses suggest positive relationships between EE and ES and mediation effects through learner autonomy.

Importance of the Study

This study offers significant contributions to theory, policy, and practice. Theoretically, it advances Autonomous Learning Theory by showing how learner autonomy mediates the relationship between entrepreneurial education and success. By integrating key theories, it presents a holistic model linking entrepreneurial education, learner autonomy, and entrepreneurial success. In terms of policy, the study highlights the need for educational programs that enhance learner autonomy to improve entrepreneurial success, supporting government efforts to foster startups and self-employment. Practically, it provides educators with insights to design curricula that foster critical thinking and adaptability, helping students transition from entrepreneurial intention to action, thus boosting start-up success rates. Methodologically, the retrospective approach captures entrepreneurs' reflections on how their education influenced their success, offering direct insights into the long-term impact of entrepreneurial education. In sum, the study connects learner autonomy with entrepreneurial education, contributing to theory, policy, and practical applications.

THEORETICAL FRAMEWORK

Theory of Planned Behavior (TPB) and Entrepreneurial Education (EE)

For years, research on entrepreneurship or entrepreneurial behavior has primarily focused on the factors influencing entrepreneurial intention, based on the belief that intention precedes action and directly correlates with it (Rohanaraj, 2023b). Ajzen's Theory of Planned Behavior is believed to be the most prominent theory in explaining the relationship between intention and behavior (Ajzen, 1985; Rohanaraj, 2023a). So, most literature focuses on explaining how the Theory of Planned Behavior (TPB) underpins entrepreneurial education by influencing intentions through attitude, subjective norms, and perceived behavioral control.

Human Value Theory and Entrepreneurial Success

Value serves as a fundamental driver of motivation and character, shaping how individuals pursue and measure success (Bardi & Schwartz, 2003). Business owners define success in ways that reflect their value orientations, which are stable, trans-situational goals guiding their behavior and decision-making (Gorgievski et al., 2011). Milton Rokeach authored *The Nature of Human Values*, a book focused on the issue of human values, which emphasized that values are a central concept in social sciences, influencing attitudes and behaviors across different domains (Rokeach, 1973). Building on Rokeach's work, Schwartz & Bilsky (1990) developed the Theory of Basic Human Values, which identifies ten universal value orientations—such as power, achievement, benevolence, universalism and so on—underpinning human behavior across cultures (Schwartz & Bilsky, 1990). Besides, Marjan J. et al. (2011) also identified that Business owners' specific evaluations of ten success criteria align with their specific value orientations (Gorgievski et al., 2011). Furthermore, the relationship between personal values and success criteria was explored by Gorgievski's (2011) study of 150 Dutch small business owners, revealing two dimensions: person-oriented success (e.g., personal satisfaction) and business-oriented success (e.g., profitability and societal contribution). Finally, the Subjective Entrepreneurial Success Scale is proposed, integrating criteria from Gorgievski et al. (2009), Dej (2010), and Augustin & Wegge (2009). This scale allows for the assessment of both the importance of entrepreneurial success criteria and the level of achievement, which mentions 24 success criteria by entrepreneurs based on the human value capital. This paper adopts this criterion to measure entrepreneurial success.

Autonomous Learning Theory and Learner Autonomy

A substantial body of literature on autonomous learning exists within adult education (Knowles, 1975). Knowles highlights that learning is fundamental to human existence, and coupled with Cell's (1984) assertion that experiential learning enhances overall awareness, one could argue that advancing self and civilization is life's ultimate purpose (Meyer, 2001a). Houle (1979) categorizes adult learners as activity-oriented, goal-oriented, or learning-oriented, with the latter seeking knowledge to fulfill an intrinsic desire (Meyer, 2001a; Tough, 1979).

Knowles (1984) emphasizes that autonomous learning is essential for adult learners. Besides, research indicates that autonomous motivation correlates with higher engagement levels (Niemic, 2009; Reeve, 2006), increased effort and persistence (Sheldon & Elliot, 1998), enhanced self-directedness, flexibility, creativity (Sheldon & Elliot, 1998), deep

learning (Niemic & Ryan, 2009; Ryan & Deci, 2000), personal goal attainment (Sheldon & Elliot, 1998), and well-being (Reeve & Jang, 2006).

Confessore&Confessore (1994) created The Learner Profile Questionnaire (LPQ) to measure perceived levels of conative factors or learner autonomy and basic self-directed learning skills. Learner autonomy emphasizes four constructs which are the desire to learn, resourcefulness, initiative, and persistence. Among them, Desire evaluates a person's ability to navigate challenges and make informed life choices (Dr. Mary Grace Neville, 2006; Meyer, 2001b); Resourcefulness reflects the extent to which individuals prioritize learning over more immediate pleasures (P. B. Carr, 1999; Dr. Mary Grace Neville, 2006); Initiative assesses a learner's goal-setting behaviors related to achieving meaningful learning outcomes (Ponton, 1999); and Persistence is the behavior of continuing action in spite of the presence of obstacles or competing goals (Derrick, 2001). In the context of entrepreneurship, fostering autonomy can empower individuals to take charge of their learning in the whole process of entrepreneurship, positively influencing their entrepreneurial behavior and the firms' success.

Since autonomy is expressed behaviorally, it is important to assess individual attitudes affecting learner autonomy (Meyer, 2001a). This could facilitate the development of targeted interventions for autonomous learning (Ponton, 1999). Moreover, Assor et al. (2002) clarified that autonomy support involved educators actively helping students develop and realized personal goals rather than merely minimizing guidance (Assor, 2002). As future entrepreneurs face increased uncertainty and risk, cultivating a robust capacity for autonomous action is essential for their success (van Gelderen, 2010).

LITERATURE REVIEW

Entrepreneurial Education and Entrepreneurial Success

Many countries are increasingly focusing on investments in education and infrastructure to transform entrepreneurial intentions into actionable outcomes. In this context, understanding the entrepreneurial ecosystem, particularly the role of entrepreneurial education (EE), is crucial for both academic literature and practical applications. While EE has attained significant attention, its impact remains ambiguous.

Fayolle (2014) highlights the equivocal nature of EE programs' effects on attitudes and behaviors, with studies reporting both positive and negative results (Dickson, 2011; Fayolle, 2013; Martin, 2013; Thompson, 2010; Dickson, 2011). On the positive side, Cui (2021) asserts that EE directly enhances entrepreneurial behavior and is positively linked to entrepreneurial success through innovation moderation. Supporting this view, Sidra Munawar (2023) demonstrates that EE fosters an entrepreneurial attitude, which in turn cultivates an entrepreneurial mindset associated with professional growth and success (Munawar et al., 2023). However, Nor Hafiza Othman (2019) emphasizes that while EE can generate intentions and develop competencies and motivations, its overall influence on entrepreneurial success warrants further investigation (Othman & Othman, 2019). Furthermore, Oosterbeek et al., (2010) holds the opinion that there is also evidence in some cases that entrepreneurship education can have a negative effect due to the realization of the difficulties involved (Fayolle & Gailly, 2015; Oosterbeek et al., 2010).

Based on what has discussion, the paper proposed the first hypothesis-H1: Entrepreneurial education is positively related to entrepreneurial success. The following Figure 1 shows the hypothesized model.

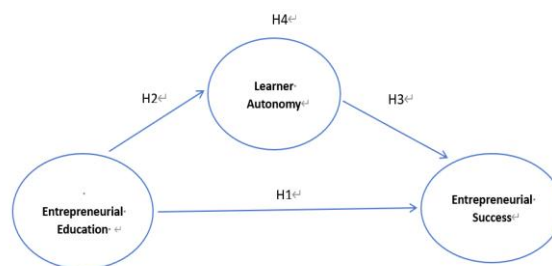


Figure 1
HYPOTHESIZED MODEL

Entrepreneurial Education and Learner Autonomy

Van Gelderen (2010) holds that autonomy should be regarded as the guiding objective of entrepreneurial education (van Gelderen, 2010) since learner autonomy is a personal or individual personality leading to the behavior or process of autonomous learning (Ng, 2011). Besides, Stouraitis et al., (2020) argue that education is intrinsically linked to autonomy, serving as a key factor, and its importance as a component in fostering entrepreneurship is widely recognized among scholars, who emphasize the pivotal role of decision-making freedom in this context (Lange, 2012; Prottas, 2008; Stouraitis, 2020). Furthermore, Van Gelderen (2010) further emphasizes the substantial influence of autonomy on educational systems and entrepreneurship curricula (van Gelderen, 2010).

Based on what has discussion, the paper proposed the second hypothesis shown in Figure 1-H2: Entrepreneurial Education is positively related to learner autonomy.

Learner Autonomy in Entrepreneurship/Entrepreneurial Success

Learner autonomy, or the capacity to learn independently, plays a crucial role in individual academic success. It is defined as the trait of exhibiting agency—intentional behavior regarding learning activities (Bandura, 2001; P. Carr, 1999; Confessore & Confessore, 1992; Derrick, 2001). Confessore (2006) emphasizes that fostering successful learners involves supporting the intentions necessary for lifelong learning, which is a principle that also applies to helping entrepreneurs thrive (Park et al., 2006). Research has shown that learner autonomy leads to higher retention rates, regulates independent learning, and promotes lifelong learning (Ng et al., 2011). Learner autonomy can be viewed as personal characteristics that drive autonomous learning behaviors. These skills are particularly vital for entrepreneurs, as the entrepreneurial journey is rife with risks and uncertainties. According to Confessore (1992), autonomous learning appears in individuals who recognize their desire to learn and leverage both internal and external resources—human and material—to enhance their efforts (Ng et al., 2012). Key autonomous learning skills include taking initiative, being resourceful in challenging situations, demonstrating persistence, and being flexible in learning approaches (Confessore, 2006). Furthermore, Confessore and Park (2002) describe functional learner autonomy as the ability and willingness to select and shape learning experiences, allowing the learner to function independently or collaboratively. The degree of engagement in functional learner autonomy reflects how effectively a learner optimizes their educational process by utilizing their resources and those of others (Ng et al., 2012). In entrepreneurship, this engagement translates into the effective use of resources, enhancing the likelihood of entrepreneurial action and success.

Based on the above discussion, the paper proposed the third hypothesis shown in Figure 1-H3: Learner autonomy is positively related to entrepreneurial success.

The Mediating Role of Learner Autonomy Between EE and ES

Anderson Galvão et.al. (2020) pointed out that entrepreneurship education has strengthened its participants' capacities and competencies, making these people more autonomous and facilitating their creation of new businesses (Galvão et al., 2020). Individuals given entrepreneurial guidance present a greater capacity for innovation, proactivity and more attraction to risk-taking, which contributes to the likelihood they will create their own businesses (Galvão et al., 2020). Besides, motivations (i.e. need for autonomy and independence; professional achievement, personal traits, higher income, attraction to risk-taking, self-realization) lead to company creation (Galvão et al., 2020), which has been advocated by authors such as Schacter et al. (2011) and Chedli (2016).

According to Munawar (2023), entrepreneurial education can be defined as "purposeful intervention by the educator in the life of the learner to impart entrepreneurial qualities and skills to confirm that the learner is capable of living in the business world" (Munawar et al., 2023 2011). The definition indicates that entrepreneurial education entails the use, creation, and implementation of innovative and proactive methods in a learning environment (Munawar et al., 2023). It's universally acknowledged that learning can enable students to acquire more knowledge and in the entrepreneurial context, a learner or entrepreneur can learn to write a business proposal, pitch a notion, do a market analysis, and so on.

Much of the literature highlights the critical role of entrepreneurship education in shaping entrepreneurial intentions. Both the knowledge and experience gained through entrepreneurship education are the most significant factors influencing students' entrepreneurial intentions (Song, 2023). However, relying solely on the drivers of entrepreneurial intention in the Theory of Planned Behavior (TPB) is insufficient due to the complexity of the entrepreneurial process, which involves multiple actions and dynamic sequences (Cui & Bell, 2022; Kautonen et al., 2015).

However, the conventional approach to entrepreneurial knowledge acquisition is no longer adequate to address the evolving demands of entrepreneurial acumen (Wei, 2019). For example, entrepreneurship education should build autonomy and comprehensive learning management for the professional ability of entrepreneurs. EE can also promote learning or autonomous learning, which is important in the process of entrepreneurship because there are many risks and challenges during the journey of entrepreneurship and its subsequent success. Therefore, the capacity/autonomy of learning is required to be mentioned in entrepreneurship education.

Research on the factors influencing entrepreneurial behavior/success includes internal or external, personal or organizational elements. Few studies explore how entrepreneurship education fosters potential entrepreneurs or enhances success through learner autonomy and autonomous learning competencies from a psychosocial aspect.

Through learner autonomy, entrepreneurship education is brought into entrepreneurship, enhancing the ability of student entrepreneurs to adapt to changes in the entrepreneurial environment. Learner autonomy facilitates autonomous learning. Driven by entrepreneurial achievement/success, entrepreneurial education constantly enhances learning methodologies and, and is dedicated to enhancing the entrepreneurial capabilities of student entrepreneurs or university students (Wei, 2019).

Based on what has discussion, the paper proposed the third hypothesis shown in Figure 1-H4: Learner autonomy mediates the relationship between entrepreneurial education and entrepreneurial success.

RESEARCH METHODOLOGY

The following part first explained the research designs, sample and populations. Then data analysis process and the instruments for data collection were also mentioned respectively.

Research Design

This research used a retrospective approach to examine entrepreneurs' reflections on their educational experiences. It sought to connect past learning with present achievements, aiming to enhance entrepreneurial education. By examining historical data, it contrasts EE's past effectiveness with current success, guiding improvements. The study focuses on causality, involving learner autonomy, and uses PLS-SEM with SPSS. Web-based surveys via Wenjuanxing collect data from a diverse group, targeting 410 graduates. Data analysis checks reliability and tests hypotheses with regression and bootstrapping.

Sample and Population

The sample of this research is university graduates/alumna entrepreneurs who have participated in entrepreneurship education and are actively managing their ventures or once-opened companies. Conducted in Shandong Province, China, the study focused on the approximately 70 colleges and universities in the region, which include 45 public institutions and 21 private ones, alongside 84 specialized vocational colleges. Questionnaires were distributed to 413 Chinese graduate entrepreneurs, and 410 valid questionnaires were collected, giving a response rate of 99.3%. Among the respondents, males accounted for 54.6% and females accounted for 45.4%, which shows a relatively balanced gender proportion (shown in Table 1). The majority of respondents fell within the age range of 24 to 36, representing 65.6% of the total, while 33.9% were under 23 years old. The respondents were all types of university graduates; undergraduate and lower levels accounted for 31.7% and 47.3%, master's and doctoral students accounted for 13.7% and 7.3%. The largest group of professionals came from humanities and social sciences, making up 34.1%. Natural sciences followed closely with 22.4%.

Demographic Constructs	Option	Frequency (n=410)	Percentage (%)
Gender	Male	224	54.60%
	Female	186	45.40%
	Other (third gender)	0	0.00%
Age	Under 23 years old	139	33.90%
	24-36 years old	269	65.60%
	Over 37 years old	2	0.50%
Highest education level	Below Undergraduate	130	31.70%
	Bachelor's degree	194	47.30%
	Master's degree	56	13.70%
	Doctorate	30	7.30%
College major	Natural sciences	92	22.40%
	Humanities and Social Sciences	140	34.10%
	Agricultural sciences	43	10.50%
	Medical sciences	51	12.40%
	Engineering and technology	84	20.50%

Procedure

Participants, aged between 23 and 37, were selected through random sampling from university networks, with additional support from faculty and career counselors in distributing questionnaires. The survey was conducted from July to August 2024, and the questionnaire, initially drafted in English, had undergone a thorough back-to-back translation process to ensure accuracy. Alumna entrepreneurs were assured that their data would be used solely for research, their details would remain private, and they had full choice to decline or withdraw from the study at any point. The study's ethical guidelines were endorsed by Qingdao University of Technology's ethics committee.

Data Collection Instruments

This research relied on reliable and valid maturity scales from international literature to ensure its empirical findings were precise. This study adopted the scales of entrepreneurship education, learner autonomy and entrepreneurial success which are suitable for alumna entrepreneurs from different matured measurements, finally forming the research scale. The alumni entrepreneurs evaluated the corresponding items based on their real situation.

This study's measurements involve a questionnaire divided into four parts. Section one collects basic details like age, gender, major, and business tenure. Section two evaluates entrepreneurial education based on learning, inspiration, and access to incubation resources through a 5-point Likert scale, following Ahmed's (2015) guidelines. Section three assesses learner autonomy with 66 items across desire, resourcefulness, initiative, and persistence, scored on a 5-point scale. Lastly, Section Four measures entrepreneurial success from 5 dimensions on a 5-point scale.

Entrepreneurial Education (EE)

This section covers three dimensions on the benefits of entrepreneurship education, using a 22-item scale from Johannisson (1991) and Souitaris et al. (2007), identified by Tariq Ahmed (Johannisson, 1991; Ahmed, 2015 ; Souitaris, 2007). The Cronbach's alpha coefficient of this scale was 0.911 (shown in Table 2), indicating that the scale has good reliability.

Variables	Cronbach's Alpha	N of Items
Entrepreneurial Education	0.911	22
Learner Autonomy	0.961	66
Entrepreneurial Success	0.897	24

The study assesses entrepreneurship education's impact through three subsections. First, according to Johannisson (1991), this learning can be categorized into five levels: values and motivation, abilities and skills, social skills and networks, experience, and intuition (Johannisson, 1991). Based on this framework, Souitaris et al. (2007) developed a scale to measure the benefits of entrepreneurship education and it evaluates if educational learning enhances entrepreneurial skills via five aspects-values, motivation, skills, networks, and experience-rated on a 5-point scale (1= not at all, 5 = to a large extent). The second subsection, "Entrepreneurship Education Inspiration Benefits," includes six items to evaluate how program events inspire graduates to pursue entrepreneurship. This is measured through Yes/No responses and a 5-point Likert scale to assess the impact on career aspirations. Inspiration, which drives creativity and motivation toward new goals (Branzei & Zietsma, 2003; Isabella, 1990), is a key element of entrepreneurship education. To measure this, Souitaris et al. (2007) developed a scale asking students to identify program events that influenced their entrepreneurial ambitions. Students respond using a 5-point Likert scale (1=not at all to 5=more than ten times) to gauge how these experiences shaped their career decisions.

The third section, 'Access to Incubator Resources,' encapsulates the insights of alumni regarding their interactions with the available resources, enumerating eleven distinct advantages. Participants were asked to evaluate their familiarity with these eleven resources on a five-point scale, ranging from 1 (never) to 5 (frequently, more than ten times).

Entrepreneurial Success (ES)

This research utilizes the Subjective Entrepreneurial Success Scale, originally developed by Dej (2010), Gorgievski (2009), Augustin&Wegge (2009), to assess entrepreneurial success. This scale evaluates the significance of various entrepreneurial success criteria and the extent to which these criteria have been achieved, taking a psychological perspective. The criteria for measuring success encompass five domains: company performance, workplace relations, community impact, personal financial rewards, and personal fulfillment. For this study, a total of 24 items will be employed, using a 5-point Likert scale. This scale has been extensively used in prior research to evaluate both the importance and the achievement of entrepreneurial success (Wach et al., 2016; Wach et al., 2020). Participants indicate their success over the past year in achieving 24 specific criteria across five facets: company performance (5 items), workplace relationships (6 items), community impact (3 items), personal financial rewards (2 items), and personal

fulfillment/balance (8 items). Responses for the importance of success criteria range from 1=not important at all to 5=very important, with an example item being, “I think innovation is important for a company.” For achievement, respondents assess their success on a scale from 1=not achieved at all to 5=very well achieved, exemplified by the item, “In the past year, I achieved work-life balance.” The results show that the overall Cronbach’s α coefficient of the Entrepreneurial Success scale is 0.897, and the scale has good reliability.

Learner Autonomy (LA)

To evaluate learner autonomy as a mediator in this research, the study utilizes the 66-item Learner Autonomy Profile-Short Form (LAP-SF) developed by Gary J. Confessore (2001), employing a ten-point Likert scale. This scale has been validated by previous studies (P. Carr, 1999; Derrick, 2001; Meyer, 2001b; Ng et al., 2011; Ponton, 1999) and encompasses constructs such as Desire, Resources, Initiative, and Persistence. Each construct addresses various behavioral intentions related to learning, with Standard Item Alphas ranging from .8992 for Initiative to .9340 for Persistence (Confessore & Park, 2004).

Specifically, the LAP-SF identifies key components of learner autonomy. For instance, Meyer (2001) describes desire as encompassing seven aspects essential for forming intentions, including understanding circumstances and basic communication skills. Carr (1999) outlines resourcefulness with seven components, such as learning priority and future orientation. Ponton (1999) distinguishes five elements of initiative, focusing on goal-directedness and self-startedness. Lastly, Derrick (2001) defines persistence through volition and goal-maintenance. The LAP-SF is derived from Version 3.0 through stepwise regression, ensuring the selected items effectively predict component scores. Ultimately, the LAP-SF aims to provide a profile reflecting the respondent’s level of learner autonomy, treating it as a psychological construct without assessing observable behaviors (Confessore & Park, 2004; Park et al., 2006). The results show that the overall Cronbach’s α coefficient of the learner autonomy scale is 0.961 which means the scale has good reliability.

Data Analysis

This study employed SPSS 26.0 and SmartPLS 4.0 for data analysis. As this is a quantitative study, statistical programs were employed. The data were analyzed using descriptive statistics, confirmatory factor analysis, internal consistency reliability, indicator loadings, convergent validity, and discriminant validity. Specifically, demographic data was summarized through descriptive statistics like frequencies and percentages. Next, factor loading, Cronbach’s Alpha (CA), Composite Reliability (CR), convergent validity (AVE), and discriminant validity (HTMT) for the measurement model were assessed. Finally, to evaluate the structural equation model, the coefficient of determination, effect size, and path coefficients were calculated using SmartPLS 4.0.

All in all, this paper outlines the methodological strategy for investigating the impact of EE on entrepreneurial success among 23 to 37-year-olds in Shandong Province, China. Participants are selected through random and snowball sampling, ensuring an accurate representation of the population, while a structured questionnaire serves as the main data collection tool, refined through pilot testing. The analysis emphasizes statistical techniques, including descriptive statistics, correlation, and regression, with a strong focus on validity and reliability to enhance the robustness of the findings.

FINDINGS AND DISCUSSIONS

Descriptive Analysis

The study, utilizing SmartPLS 4.0, discovered that a significant portion of respondents (37.1%) felt university education greatly aided their self-employment, while 29.3% found it quite beneficial. This indicated that 66.4% of surveyed entrepreneurs recognized the value of entrepreneurial education in their ventures. Nonetheless, 53.6% either didn't express a favorable view (16.6% neutral, 10.7% unhelpful, and 6.3% unrelated) suggesting room for improvement in entrepreneurial education at higher institutions.

Constructs	Option	Frequency (n=410)	Percentage
		(n=410)	(%)
Founding date of the company	During university	150	36.60%
Business field	1-5 years after university	194	47.30%
	6-10 years after university	66	16.10%
	Digital entrepreneurship (internet-related)	69	16.80%
	Manufacturing and industry (including construction)	76	18.50%
	Agriculture and food	61	14.90%
	Medicine, health, and life sciences	55	13.40%
	Energy and environment	56	13.70%
	Services	93	22.70%
Duration of the company	Less than 3 years	108	26.30%
	3-10 years	204	49.80%
	Over 10 years	98	23.90%
The usefulness of university education for entrepreneurship	Very helpful	152	37.10%
	Quite helpful	120	29.30%
	Average	68	16.60%
	Not very helpful	44	10.70%
	Not at all helpful	26	6.30%

Based on the above Table 3, a significant portion of entrepreneurs established their businesses: 36.6% while in college, 47.3% within one to five years post-graduation, and 16.1% within six to ten years after graduation. As for Business field, entrepreneurship in service industries, such as finance, education, e-commerce, trade consulting, food services, culture, logistics, dominated with 22.7% of choices. Manufacturing and industrial sectors, including construction, internet-based ventures, and energy-environmental fields rounded out the top picks. When mentioning the usefulness of university education for entrepreneurship, a significant majority of respondents (66.4%) found university education highly beneficial for their entrepreneurial pursuits. Yet, 53.6% either didn't express a clear positive view (16.6%) or gave negative responses (10.7% felt it unhelpful, and 6.3% saw no connection). Some

remained neutral, selecting 'average' (16.6%). This results show that there needs some improvements on entrepreneurial education.

Common Method Bias

This study, employing a singular data source, initiated the detection of Common Method Bias in accordance with the methodologies proposed by Kock and Lynn (2012) and Kock (2015). The Full Collinearity Test (shown in Table 4) is a statistical technique used to detect common method bias (CMB) as well as multicollinearity in structural equation modeling (SEM) or regression-based analyses. It evaluates the collinearity among all predictor and criterion variables, identifying whether any inflated relationships between variables are due to shared variance caused by the method of data collection, as opposed to real underlying relationships. This technique was introduced as part of the Variance Inflation Factor (VIF) approach to test for both multicollinearity and common method bias simultaneously. The assessment entails regressing all variables against a shared variable; if the Variance Inflation Factor (VIF) remains below 3.3, it indicates that the potential bias stemming from single-source data is negligible (Kock, 2015; Kock & Lynn, 2012).

Variables	VIF(<3.3)
Access to Incubation Resources	1.255
Collective Digital Communication	1.677
Community Impact	1.451
Desire to learn	1.432
Digital knowledge	1.313
Firm performance	1.408
Individual Digital Communication	1.490
Information Management	1.247
Initiative	1.329
Inspiration	1.638
Learning	1.560
Network Collaborative Learning	1.530
Network Leadership	1.549
Persistence	1.424
Personal Financial Rewards	1.550
Personal Fulfilment	1.336
Resourcefulness	1.307
Workplace relations	1.394

Measurement Model Assessment

The measurement model analysis is based on Hair Jr's (2021) steps and it includes four key phases: checking indicator reliability with factor loadings over 0.7, ensuring internal consistency with Cronbach's alpha or composite reliability are both greater than 0.7. Confirm convergent validity with AVE above 0.5, and discriminate validity between constructs with an HTMT ratio of 0.85.

Indicator Reliability and Factor Loadings

A measurement model's trustworthiness depends on factor loadings, which measure the strength of the link between visible variables and their hidden causes. These loadings illustrate the tightness of the connection between observed and hidden factors. A measurement model is considered reliable if each item has a loading of 0.7 or higher and shows statistical significance at the 0.05 level (Chin, 1998), see table 5.

Variables	Recoding	Estimate	T-value	P-value
Learning	LE1	0.775	33.521	0.000
	LE2	0.787	36.944	0.000
	LE 3	0.796	38.750	0.000
	LE 4	0.762	30.227	0.000
	LE 5	0.811	42.594	0.000
Inspiration	INS1	0.780	38.336	0.000
	INS 2	0.783	40.976	0.000
	INS 3	0.809	44.789	0.000
	INS 4	0.818	48.904	0.000
	INS 5	0.798	41.481	0.000
	INS 6	0.809	44.261	0.000
Access to Incubation resources	ATIR1	0.797	40.493	0.000
	ATIR2	0.770	34.768	0.000
	ATIR3	0.749	30.967	0.000
	ATIR4	0.737	26.535	0.000
	ATIR5	0.772	33.971	0.000
	ATIR6	0.771	33.355	0.000
	ATIR7	0.779	37.542	0.000
	ATIR8	0.741	29.041	0.000
	ATIR9	0.783	37.538	0.000
	ATIR10	0.787	36.036	0.000
	ATIR11	0.744	29.888	0.000
Desire to learn	DTL1	0.759	22.747	0.000
	DTL2	0.765	28.609	0.000
	DTL3	0.808	34.656	0.000
	DTL4	0.782	26.996	0.000
	DTL5	0.762	25.923	0.000
	DTL6	0.737	22.553	0.000
	DTL7	0.748	24.311	0.000
	DTL8	0.750	23.124	0.000
	DTL9	0.783	25.765	0.000
	DTL10	0.796	36.738	0.000
	DTL11	0.734	21.881	0.000
	DTL12	0.765	25.811	0.000

	DTL13	0.748	23.257	0.000
	DTL14	0.773	30.040	0.000
	DTL15	0.774	31.441	0.000
	DTL16	0.725	21.299	0.000
	DTL17	0.726	21.078	0.000
	DTL18	0.773	27.777	0.000
	DTL19	0.738	25.051	0.000
	DTL20	0.752	25.312	0.000
	DTL21	0.705	20.379	0.000
Initiative	INI1	0.731	21.930	0.000
	INI2	0.664	15.392	0.000
	INI3	0.758	25.941	0.000
	INI4	0.717	18.643	0.000
	INI5	0.688	17.984	0.000
	INI6	0.717	21.722	0.000
	INI7	0.748	23.708	0.000
	INI8	0.733	22.513	0.000
	INI9	0.691	17.183	0.000
	INI10	0.724	22.549	0.000
	INI11	0.742	23.720	0.000
	INI12	0.688	16.940	0.000
	INI13	0.753	25.938	0.000
	INI14	0.710	21.719	0.000
	INI15	0.759	22.542	0.000
Resourcefulness	RE1	0.739	20.389	0.000
	RE2	0.741	21.850	0.000
	RE3	0.766	30.162	0.000
	RE4	0.747	25.576	0.000
	RE5	0.707	20.885	0.000
	RE6	0.748	23.733	0.000
	RE7	0.775	33.961	0.000
	RE8	0.772	34.193	0.000
	RE9	0.712	22.525	0.000
	RE10	0.747	26.294	0.000
	RE11	0.769	28.912	0.000
	RE12	0.779	29.624	0.000
	RE13	0.768	27.212	0.000
	RE14	0.746	25.247	0.000
	RE15	0.776	30.904	0.000
	RE16	0.735	24.654	0.000
	RE17	0.713	21.678	0.000
	RE18	0.780	29.311	0.000
	RE19	0.807	37.538	0.000

	RE20	0.729	22.122	0.000
	RE21	0.747	25.901	0.000
Persistence	PE1	0.773	27.246	0.000
	PE2	0.769	27.122	0.000
	PE3	0.739	22.540	0.000
	PEP4	0.791	31.477	0.000
	PEP5	0.696	15.810	0.000
	PE6	0.712	18.044	0.000
	PE7	0.721	19.073	0.000
	PE8	0.757	22.300	0.000
	PE9	0.736	21.388	0.000
Firm performance	FP1	0.770	30.947	0.000
	FP2	0.786	38.003	0.000
	FP3	0.777	34.050	0.000
	FP4	0.842	47.916	0.000
	FP5	0.701	19.723	0.000
Workplace relations	WR1	0.787	33.779	0.000
	WR2	0.799	39.118	0.000
	WR3	0.754	30.762	0.000
	WR4	0.771	33.280	0.000
	WR5	0.769	31.978	0.000
	WR6	0.780	31.770	0.000
Personal Fulfilment	PF1	0.830	53.534	0.000
	PF2	0.772	37.126	0.000
	PF3	0.790	42.893	0.000
	PF4	0.791	39.870	0.000
	PF5	0.790	41.998	0.000
	PF6	0.767	36.270	0.000
	PF7	0.771	34.537	0.000
	PF8	0.770	39.089	0.000
Community Impact	CI1	0.864	59.981	0.000
	CI2	0.827	44.955	0.000
	CI3	0.853	56.254	0.000
Personal Financial Rewards	PFR1	0.863	44.280	0.000
	PFR2	0.907	66.763	0.000

Based on the above description, this research found that the factor loading coefficients of most variables were in the high range (>0.7), which indicated that the strength of the relationship between the observed variables and their corresponding latent variables was all high. According to Kock (2012), factor loadings above 0.7 are considered ideal, as they explain a large portion of the variance in the observed variable. If factor loading is between 0.4 to 0.7, it is still acceptable, though they suggest the variable is moderately related to the factor. Based on the results, all items used for this study had demonstrated satisfactory indicator reliability.

Internal Consistency Reliability

Cronbach's alpha (CA) is a common method to assess a measurement tool's internal consistency. It indicates how well the items within a group align, suggesting they measure the same concept effectively (Cronbach,1971). Table 6 shows the Cronbach's alpha and Composite reliability of each variable.

Construct Name	Items	Cronbach's alpha (>0.7)	Composite reliability (>0.7)
	Inspiration	0.887	0.914
EE	Learning	0.847	0.891
	Access to Incubation resources	0.930	0.940
	Desire to learn	0.963	0.966
LA	Initiative	0.934	0.942
	Resourcefulness	0.962	0.965
	Persistence	0.899	0.918
	Firm performance	0.835	0.884
ES	Workplace relations	0.870	0.902
	Personal Fulfilment	0.911	0.928
	Community Impact	0.806	0.885
	Personal Financial Rewards	0.728	0.879

Based on, Cronbach's alpha and Composite reliability for all latent variables were at relatively high levels and all were 0.7, indicating that these latent variables possessed good reliability.

Convergent Validity Convergent Validity is one of two crucial concepts in evaluating Confirmatory Factor Analysis, used to determine whether constructs or factors can be appropriately measured and distinguished. Convergent validity can be evaluated using two key approaches: Factor Loadings, which measure the intensity of the link between observed variables and hidden factors, and Average Variance Extracted (AVE), a metric presented in Table 7, to determine the average percentage of variation in the observable variables attributed to each latent factor.

Construct Name	Items	Average variance extracted (>0.5)
	Inspiration	0.640
Entrepreneurial Education	Learning	0.620
	Access to Incubation resources	0.589
	Desire to learn	0.575
Learner Autonomy	Initiative	0.522
	Resourcefulness	0.567
	Persistence	0.555
	Firm performance	0.605
	Workplace relations	0.605
Entrepreneurial Success	Personal Fulfilment	0.618

	Community Impact	0.720
	Personal Financial Rewards	0.785

According to Fornell and Larcker's criterion, An AVE value above 0.5 is generally considered acceptable, and above 0.7 is considered good (Fornell & Larcker, 1981). According to Table 7, the AVE values of latent variables were between 0.522-0.785, indicating that these latent variables possess good convergent validity.

Discriminant Validity

Discriminant Validity is another concept in evaluating Confirmatory Factor Analysis. The concept of discriminant validity ensures that a latent factor stands out clearly from other factors in a multi-measure study. According to Fornell and Larcker's criterion, the square root of the AVE (diagonal values) for each construct should be greater than the corresponding correlation coefficients, demonstrating sufficient discriminant validity (Fornell, 1981). The results for this step are shown in Table 8 which represents the square roots of the AVE and the inter-correlation value between constructs.

Construct Name	Items	The square root of AVE	Row maximum	Column maximum	Maximum
	Learning	0.800	0.645	0.423	0.645
EE	Inspiration	0.787	0.399	0.405	0.405
	Access to Incubation resources	0.767	0.323	-	0.323
	Desire to learn	0.758	0.303	0.362	0.362
LA	Initiative	0.722	0.339	0.405	0.405
	Resourcefulness	0.753	0.390	0.262	0.390
	Persistence	0.745	0.466	0.390	0.466
	Firm performance	0.778	0.448	-	0.448
	Workplace relations	0.778	0.466	0.398	0.466
ES	Personal Fulfilment	0.786	0.442	0.459	0.459
	Community Impact	0.849	0.448	0.334	0.448
	Personal Financial Rewards	0.778	0.448	-	0.448

According to, the square roots of the AVE for all variables (in bold) were greater than the maximum absolute value of the inter-factor correlation coefficient, or all off-diagonal elements were lower than square roots of AVE, indicating that there was good discriminant validity among the variables. Hence, the result confirmed that the Fornell and Larcker's criterion was met.

Structural Equation Model Analyses

The following part explains the direct relationship between the three variables, and the indirect relationship through the mediator-digital literacy and the strength of the mediator to identify the mediating role of digital literacy.

The direct relationship between EE and ES

The first research objective is to explore the relationship between entrepreneurial education and entrepreneurial success, addressing the question-How does entrepreneurial education impact entrepreneurial success? According to the data, the path coefficient of 0.299 indicates a positive direct effect of entrepreneurial education on entrepreneurial success, with a t-value of 6.480 ($\beta=0.299$; $p=0.000$), confirming its significant impact and H1 is supported (Shown in Table 9). This aligns with studies by Kolstad & Wiig (2011), Dickson & Weaver(2011), and Maziriri et al. (2024), which emphasize the role of entrepreneurial education in improving access to funding, business growth, and market readiness(Dickson & Weaver, 2011; Kolstad & Wiig, 2011; Maziriri et al., 2024).

The direct relationship between LA and ES, EE and LA

The second research objective is to examine the relationship between learner autonomy (LA) and entrepreneurial success (ES). Based on data analysis, the path coefficient of LA and ES is 0.169 indicating a modest positive effect of learner autonomy on entrepreneurial success, with a t-value of 3.782, confirming a significant relationship. The direct effect results show that learner autonomy positively affects entrepreneurial success ($\beta=0.169$; $t=3.782$, $t>1.645$; $p=0.000$, $p<0.05$), and H3 is supported (Shown in Table 9). This aligns with studies by Carosa (2022), Blacksmith (2023), Confessore & Park (2002), and Foen Ng et al. (2012), showing that learner autonomy enhances entrepreneurial performance/success through optimizing resources.

Besides, the direct effect between EE-LA (shown in Table 9) indicates that entrepreneurial education is positively related to learner autonomy ($\beta=0.529$; $t=13.668$, $t>1.645$; $p=0.000$, $p<0.05$),and then H2 is supported. This is supported by van Gelderen(2010), Lange(2012), Stouraitis, V et al., (2020) that autonomy is strongly associated with entrepreneurship.

Hypotheses	Relationshi p	Std.Beta	STDE V	T values	P values	PCI LL	PCI UL	f2	Results
						5%	95%		
H1	EE -> ES	0.299	0.043	6.899	0	0.227	0.369	0.106	supported
H2	EE -> LA	0.529	0.039	13.668	0	0.466	0.592	0.387	supported
H3	LA -> ES	0.169	0.045	3.782	0	0.093	0.243	0.041	supported

Note: This research uses 95% confidence interval and one-tailed type with a bootstrapping of 5,000. The study's research hypotheses were tested based on the values of the t-stats as prescribed by Hair et al.(2017)that t-stat values must be >1.645 and p-values <0.05 (Hair Jr, 2017).

Hypotheses	Relationship	Std. Beta	Standard deviation (STDEV)	T values	P values	PCI LL	PCI UL	Results
		(>0.05)				5%	95%	
H4	EE-> LA -> ES	0.089	0.024	3.75	0	0.05	0.13	supported

Note: This research uses 95% confidence interval and one-tailed type with a bootstrapping of 5,000. The study's research hypotheses were tested based on the values of the t-stats as prescribed by Hair et al. (2017). They suggest that t-stat values must be >1.645 and p-values <0.05 (Hair Jr, 2017)

The indirect effect of EE on ES through learner autonomy

The third research objective is to assess the mediating role of learner autonomy in the relationship between entrepreneurial education and entrepreneurial success. The study found that learner autonomy partially mediates this relationship, with entrepreneurial education influencing entrepreneurial success both directly and indirectly through learner autonomy. To measure this mediation, the research calculated the indirect effect by multiplying the two path coefficients ($0.529 \times 0.169 = 0.089$). The total effect of entrepreneurial education on success is 0.388, combining the direct effect (0.299) and the indirect effect (0.089). The indirect effect, with a β value of 0.089 and p-value of 0.000, confirms the significance of the mediation. This suggests that entrepreneurial education enhances learner autonomy, which in turn contributes to entrepreneurial success, though entrepreneurial education also maintains a direct influence on success. Since the mediating effect of learner autonomy was 0.089, with 95% confidence interval [0.050, 0.130], which excluded 0, H4 was also verified (shown in Table 10).

Variance Accounted For (VAF) for learner autonomy

According to Hair (2013), the Variance Accounted For (VAF) was used to measure the strength of the mediation (Hair et al., 2013). The VAF was 22.94%, meaning that 22.94% of the total effect is explained by the mediation of learner autonomy. Since the VAF falls between 20% and 80%, this indicates partial mediation.

In conclusion, based on Table 11, learner autonomy partially mediates the relationship between entrepreneurial education (EE) and entrepreneurial success (ES), with 22.94% of the effect being mediated, while the direct effect remains significant. This aligns with studies by Matlay and Van Gelderen (2010), Kgagara (2011), Stouraitis et al. (2020), and Munawar (2023), which also found that autonomy plays a key role in education, with functional learner autonomy contributing to the use of resources and leading to entrepreneurial success (Munawar et al., 2023; Stouraitis & M., 2020).

Total effect		Direct effect				Indirect effect			
EE-ES		EE-ES				EE-LA-ES			
β	P-value	β	T-value	P-value	β	SD	T-value	P-value	
0.388	0	0.299	6.899	0	0.089	0.024	3.75	0	
Variance accounted					22.94 % Partial Mediation				

for (VAF)								
VAF=0.089/0.388*100=22.94					VAF=22.94 %(partial mediation effect)			

Note: Learner autonomy has a partial mediation effect(22.94 %). EE: Entrepreneurial Education ; ES: Entrepreneurial Success ;LA: Learner Autonomy

IMPLICATIONS IN THEORY, PRACTICE AND METHODOLOGY

The subsequent segment outlines the research's implications from three distinct perspectives: theory, practice, and methodology.

Implications for Theory

This research integrates retrospective theory from the medical field into education, offering a new analytical framework to assess how past educational practices influence current learning outcomes and entrepreneurial success. Additionally, the study draws on self-directed learning and self-regulation theory, examining intrinsic and extrinsic motivators—such as the desire to learn, initiative, resourcefulness, and persistence—that drive learner autonomy in entrepreneurial education. By emphasizing the importance of lifelong learning, it underscores the role of self-directed learning in fostering entrepreneurial abilities and adjusting to ever-changing business landscapes. This study broadens the understanding of psychosocial disposition in relation to entrepreneurship, examining its effects on both success and learning. It focuses on how learner autonomy, a key psychosocial factor, affects business outcomes, emphasizing its importance for overall entrepreneurial success through enhanced learning ability obtained in entrepreneurial education.

Implications for Practice

This research highlights that Entrepreneurial Education impacts success both directly and indirectly through Learner Autonomy and Digital Literacy, offering key insights for educators, policymakers, and program designers. First, strengthening Entrepreneurial Education is crucial. Educational institutions should design curricula that not only teach practical business skills but also foster autonomy in learners, ensuring students are equipped with both the knowledge and mindset needed for entrepreneurial success. Secondly, enhancing learner autonomy is essential across all types of education. When students take control of their learning, they are more likely to succeed in entrepreneurial endeavors. Programs that encourage self-directed learning, critical thinking, and decision-making will amplify the benefits of entrepreneurial education. Incorporating mentorship and coaching, hands-on projects, and experiential learning can further enhance student autonomy. Thirdly, it's important to maintain a balanced focus on both the direct and indirect effects of education. While entrepreneurial education directly impacts success, fostering autonomy also plays a significant indirect role. Creating learning environments that promote autonomy, resilience, and a growth mindset will empower students to maximize their potential.

Implications for Methodology

This study uses a backward-looking method where entrepreneurs share how their previous business learning got from entrepreneurial education shaped their current achievements. However, recall bias might occur where people's memories can be influenced by their present circumstances, affecting their evaluations. To address this, future research,

future research is recommended to adopt a long-term study following entrepreneurs from their educational backgrounds into their work lives, leading to more precise estimates of education's effects. This study highlights learner autonomy as a mediating factor in understanding entrepreneurial education's impact. To gain a fuller picture, future research should utilize mixed methods, integrating both quantitative data and in-depth interviews, to explore how these intermediary factors interconnect with educational experiences. In summary, while the retrospective design provides valuable insights into the long-term impacts of entrepreneurial education, it also underscores the need to address recall bias, integrate evolving trends like learner autonomy, and explore more comprehensive methodologies, such as longitudinal and mixed-methods approaches, for future research.

CONCLUSION

This part synthesises the main findings of the research. The limitations and suggestions for future research are also mentioned.

Summary of Key Findings

Entrepreneurial Education (EE) has a direct effect on Entrepreneurial Success (ES) with a coefficient of 0.299, and it also influences ES indirectly through Learner Autonomy (LA), with coefficients of 0.089. Learner Autonomy serves as a partial mediator in this relationship; individuals with higher learner autonomy are more inclined to take initiative, seek out resources, and persist in their endeavors to learn effectively.

Limitations and Recommendations for Future Research

The study uncovers crucial connections between entrepreneurial education and entrepreneurial success, yet it has some limitations. Primarily, its focus on Shandong Province in China restricts the global applicability of the results. Regional variations in educational contexts, culture, and economies might influence the effectiveness of entrepreneurship education. Additionally, the retrospective nature of the study also introduces recall bias, where participants may have idealized or underestimated past educational experiences based on their current success. Moreover, the study did not delve deeply into the specific content of entrepreneurial education programs, such as experiential learning or mentorship, which could offer more detailed insights. External factors like social networks, access to capital, and economic conditions were also not considered, limiting the ability to isolate the true effect of education on entrepreneurial success.

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