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Exploring the influence of educational capital on college students' entrepreneurial performance: a moderated multi-mediation model approach

Zheng Li[1], Xinghua Wang[2]✉, Kejun Zhang[2], Tian Zheng[3], Jianhua Zhou[3], Taghreed Ali Alsudais[4] & Xiaotong Zhi[2]✉

Entrepreneurship education significantly enhances college students' entrepreneurial abilities, yet its intricate impact on entrepreneurial performance remains largely unexplored. Addressing this research gap, our study analyzed 2179 entrepreneurial college students from four provinces in mainland China using a structural equation model. We investigated how educational capital—comprising human capital, social capital, and psychological capital—influences entrepreneurial performance, which encompasses financial performance, growth performance, and innovation performance. Our findings revealed that educational capital directly boosts entrepreneurial performance and indirectly affects it through the mediation of entrepreneurial training, which includes opportunity identification, team building, resource acquisition, and strategic planning. Additionally, social support plays a crucial moderating role in the relationship between educational capital and entrepreneurial training. These results underscore the importance of educational capital accumulation and transformation for improving entrepreneurial performance, with entrepreneurial training and social support serving as pivotal factors. Our study offers fresh insights into the impact mechanism of entrepreneurship education on entrepreneurial performance and suggests new avenues for optimizing such education.

[1] Shaoxing University, Shaoxing, China. [2] Qingdao University, Qingdao, China. [3] Ganzhou Teachers College, Ganzhou, China. [4] Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia. ✉email: wangxinghua379@gmail.com; zhixiaotong@qdu.edu.cn

Introduction

Entrepreneurship education has become an indispensable part of the global higher education system in the knowledge economy. Its value lies in cultivating students' innovative thinking, risk-taking ability, and entrepreneurial spirit, thereby effectively promoting entrepreneurial activities among college students in complex economic environments (Valliere et al. 2014). However, the persistently low success rate of student entrepreneurship remains a significant challenge, Furthermore, the absence of consensus on fundamental definitions has led to a lack of consistency in the classification of entrepreneurship education activities (Liñán 2004), prompting academia to reassess the effectiveness of current entrepreneurship education. On the one hand, entrepreneurship education positively impacts students' knowledge literacy, technical application abilities, and social network construction, bringing educational capital to student entrepreneurs and helping them achieve entrepreneurial performance. On the other hand, while the accumulation of educational capital is generally believed to enhance entrepreneurial success rates, the specific processes and mechanisms by which educational capital translates into entrepreneurial performance are not yet fully understood.

To address this gap, this study investigated 2179 entrepreneurial college students from Zhejiang, Fujian, Shandong, and Guangdong provinces in mainland China, using structural equation modeling tools to analyze the comprehensive impact of educational capital on entrepreneurial performance. It aimed to answer the following questions: (1) Does increasing educational capital help college student entrepreneurs achieve high entrepreneurial performance? (2) What are the direct and indirect mechanisms by which educational capital influences entrepreneurial performance? What roles do entrepreneurial practical training and social support play in this process? Academic exploration of these questions cannot only deepen our understanding of how entrepreneurship education affects entrepreneurial performance among college students but also provide empirical evidence for policymakers and educators to improve the quality of entrepreneurship education and design more targeted teaching strategies.

Literature review and hypotheses development

Literature review. Resource-based theory posits that heterogeneous capital is a primary factor leading to significant differences in entrepreneurial performance within the same group (Wan et al. 2011). College students' entrepreneurial performance depends on the close cooperation between the entrepreneurship education system and the social entrepreneurship system, with heterogeneous educational capital likely playing a crucial role (Neck and Greene 2011). Current academic perspectives on educational capital mainly include educational economics and educational sociology. Educational economics examines the economic benefits of resource investment in specific educational fields from the perspective of education investors. In contrast, educational sociology explores the extent of capital gains that students, as education beneficiaries, achieve from such investments (Thomassen et al. 2019).

This study adopts the latter perspective, considering educational capital as the comprehensive capital composition of knowledge, skills, and opportunities acquired during the entrepreneurship education process that students transform into entrepreneurial practice benefits (i.e., information, abilities, and investments). Furthermore, there is ongoing debate about the concept definition of educational capital compared to traditional three-dimensional capital (i.e., human capital, psychological capital, and social capital). Some viewed educational capital as an independent form of heterogeneous capital, believing that it depended on the regional education level and government education support, and played a significant regulatory role in influencing entrepreneurship and environmental quality (Omri and Afi 2020), while others viewed it as fundamentally similar to traditional three-dimensional capital, capable of transforming into learners' human capital, psychological capital, and social capital under certain conditions (Fan 2018).

This study tended to concentrate on the latter perspective, contending that educational capital embodies a transformational relationship among educational resources. In the context of entrepreneurship education, resources like knowledge, skills, and social interactions could be converted into capital that enhances students' entrepreneurial performance. This educational capital encompasses various forms, including human capital (HC), psychological capital (PC), and social capital (SC). These forms of capital within the realm of education were not autonomous; rather, they interacted and, in some instances, transformed into one another (Alomani et al. 2022). Specifically, HC encompasses the capitalized effects of students' entrepreneurial knowledge, skills, and physical and mental well-being after engaging in entrepreneurship education, and it is generally considered to have a positive impact on entrepreneurial intention (Aboobaker and Renjini 2020; Marvel et al. 2016). PC pertains to the capitalized impact of students' self-confidence, self-efficacy, innovativeness, and adventurousness. Entrepreneurship education should be combined with some PC attributes to be effective (Haddoud et al. 2024). SC refers to the capitalized benefits derived from students' social integration and access to societal resources, and it is considered to help promote nascent entrepreneurial behavior (Cai et al. 2021).

Entrepreneurial performance refers to the outcomes and corresponding efficiency achieved by entrepreneurs during the entrepreneurial process (Li and Setiawan Sanusi 2023). For college student entrepreneurs, it reflects the value of their entrepreneurial practice and the effectiveness of the entrepreneurship education they received (Obschonka et al. 2010). Scientifically assessing entrepreneurial performance is a hot topic in entrepreneurship education research, with institutions like Harvard Business School and Babson College conducting annual evaluations to explore the essential connections between entrepreneurial success factors and entrepreneurship education. Other scholars have attempted to construct and improve performance evaluation models to assess entrepreneurship education, such as the CIPP (Context evaluation, Input evaluation, Process evaluation, Product evaluation) model performance evaluation index system proposed by Eryanto et al. (2019).

The Knowledge Distance Theory holds that there is a significant "knowledge distance" between the knowledge transmitter and the receiver in terms of knowledge, experience, background, etc. Generally speaking, the smaller the "knowledge distance", the higher the success rate of knowledge transfer (Fei 2011). To reduce the "knowledge gap" between capital investment in entrepreneurship education and the output of college students' entrepreneurial performance, two logical paths are usually chosen: internal and external. The internal logic mainly focuses on the continuous improvement and comprehensive optimization of entrepreneurship education by universities themselves. For example, the "Learning by doing" theory suggests that the most effective way to learn is to gain experience through practical operations and exploration (Drake 2022). In entrepreneurship education, entrepreneurship training is considered an extremely important teaching form and path. Some scholars believe that the best form of entrepreneurship education is practical education (Chandler and Lyon, 2001). At the same time, research has shown

that entrepreneurship training may play a mediating role between pre-education investment and entrepreneurial performance (Li 2017). Therefore, this study attempts to use entrepreneurial training as the main mediating variable that reflects the internal logic and explores the internal impact of educational capital on entrepreneurial performance. Considering that entrepreneurial training is a multifactorial process, this study adopts the three elements of the entrepreneurial process model proposed by American scholar Timmons (1999), namely opportunity identification (OS), team building (TB), and acquisition resource (AR), to construct the main dimensions of the entrepreneurial training module. At the same time, due to the strategic management theory, it is believed that strategic awareness is an important factor leading to significant performance differences in startups, and empirical research has increasingly recognized that the capabilities and resources of startups must be matched with strategy to achieve competitive advantage. Therefore, the consideration of strategic planning (SP) factors is added to the entrepreneurship training module to fill the relevant research gap.

This study, based on relevant theoretical discussions, defines college student entrepreneurial performance as the specific degree of task completion or goal achievement during entrepreneurial practice, encompassing three dimensions: financial performance (FP), growth performance (GP), and innovation performance (IP), to represent the comprehensive impact of entrepreneurship education.

Research hypotheses and model construction. The gradually maturing and improving entrepreneurship education system is increasingly recognized for its positive impact on entrepreneurial performance. College students are generally considered to have higher levels of proactive personalities, making them more likely to exhibit stronger entrepreneurial intentions and more ideal entrepreneurial performance (Obschonka et al. 2011). Further research indicates that entrepreneurship education has a positive organizational promotion effect in this process (Kucel et al. 2016), which can be viewed as an educational investment process enhancing the value of educational capital.

As the contribution of educational investment to economic growth is increasingly recognized, the investment, evaluation, and performance impact of educational capital have become hot issues in higher education. It is generally believed that various forms of capital, including human capital and social capital, significantly affect the growth performance of new ventures, although the direction and strength of their relationship with entrepreneurial performance remain inconsistent (Stam et al. 2014). Some scholars, from the perspective of entrepreneurial opportunities, have analyzed the role of heterogeneous resources in entrepreneurial performance and proposed and confirmed the research logic of resource-opportunity-performance (Ji and Zhuang 2023). Other studies have confirmed that entrepreneurial practical training significantly empowers the realization of college students' entrepreneurial performance (Tan and Qian 2015), providing a new perspective for re-examining the process of entrepreneurial education's performance manifestation from the angle of resource utilization and transformation.

To address the internal and external issues within this study's proposition, the foremost concern is the internal transformation of educational capital, specifically, how educational capital is converted through the educational process between educators and learners. One possibility is that social capital, cultural capital, economic capital, and human capital are transformed into educational capital, which then circulates between educators and learners through their educational relationship. Entrepreneurial practical training may play a crucial mediating role in this complex process. Therefore, this study proposes the following hypotheses:

H1: Educational capital positively affects entrepreneurial performance.

H1a: Human capital positively affects entrepreneurial performance.

H1b: Psychological capital positively affects entrepreneurial performance.

H1c: Social capital positively affects entrepreneurial performance.

H2: Educational capital positively affects entrepreneurial practical training.

H2a: Educational capital positively affects opportunity identification.

H2b: Educational capital positively affects acquisition resource.

H2c: Educational capital positively affects team building.

H2d: Educational capital positively affects strategic planning.

H3: Entrepreneurial practical training mediates the relationship between educational capital and entrepreneurial performance.

H3a: Opportunity identification mediates the relationship between educational capital and entrepreneurial performance.

H3b: Acquisition resource mediates the relationship between educational capital and entrepreneurial performance.

H3c: Team building mediates the relationship between educational capital and entrepreneurial performance.

H3d: Strategic planning mediates the relationship between educational capital and entrepreneurial performance.

In addition to internal hypotheses, this study also focuses on the external transformation of educational capital. As a highly social teaching activity, high-quality entrepreneurship education relies on ample social support. An empirical study on 31 regions in China showed that the impact of educational human capital on economic growth was limited and varied greatly depending on the level of social support in different regions (Hongbing and Finance 2014). Social support is considered to moderate various interactive relationships in the entrepreneurial teaching process, including proactive personality and college students' entrepreneurial preparation behavior, entrepreneurial pressure and exit intentions, and entrepreneurial emotions and behaviors (Krueger et al. 2000). This study further explores the moderating mechanism of social support between educational capital and entrepreneurial performance. Therefore, this study proposes the following hypotheses:

H4: Social support positively moderates the relationship between educational capital and entrepreneurial performance.

H5: Social support positively moderates the relationship between educational capital and entrepreneurial practical training.

H5a: Social support positively moderates the relationship between educational capital and opportunity identification.

H5b: Social support positively moderates the relationship between educational capital and acquisition resource.

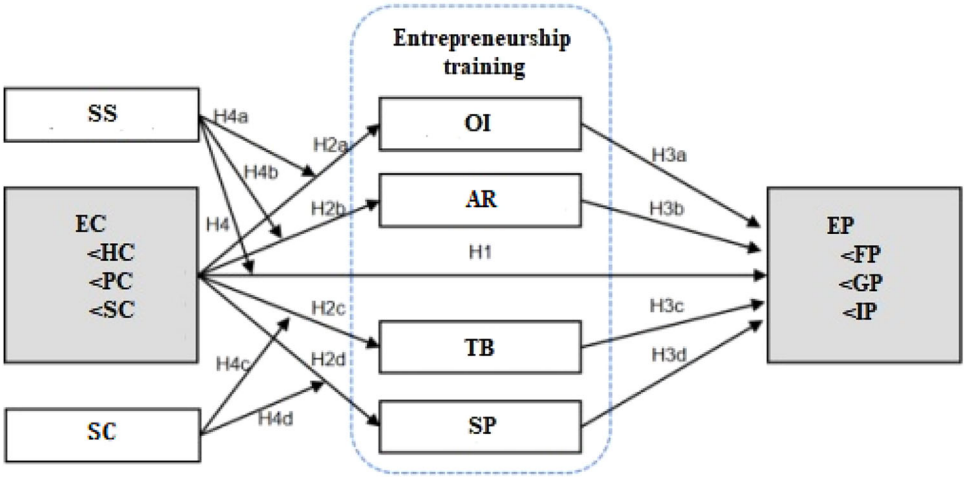

Fig. 1 Hypothesized research model. SS social support, OI opportunity identification, AR acquisition resource, TB team building, SP strategic planning, HC human capital, PC psychological capital, SC social capital, FP financial performance, GP growth performance, IP innovation performance.

H5c: Social support positively moderates the relationship between educational capital and team building.

H5d: Social support positively moderates the relationship between educational capital and strategic planning.

Based on the 3P model (Precondition-Process-Product) proposed by educational psychologist Biggs (1987), the process of achieving college students' entrepreneurial performance can be viewed as a capital investment, transformation, and appreciation process, starting from the resource input of the education subject (entrepreneurship mentors), through the entrepreneurial practice of the education object (entrepreneurs), to the performance of the entrepreneurial team. This study considers the entire implementation of entrepreneurship education and students' entrepreneurship as a "capital → practical training → performance" transformation process, exploring the hypothesized model of the impact mechanism of educational capital on entrepreneurial performance (see Fig. 1), aiming to verify the interaction among the three main variables and the moderating role of social support through model construction and analysis.

Methodology

Research setting and participants. The participants of this study were entrepreneurial college students recruited from 24 universities in Zhejiang, Fujian, Shandong, and Guangdong provinces. This study was approved by the Ethics Committee of Qingdao University. A total of 2400 questionnaires were distributed to students who had participated in entrepreneurial activities, had entrepreneurial experience, and had achieved certain entrepreneurial performance. Informed consent was obtained from the participants. We collected 2257 questionnaires, with 2179 valid responses, resulting in a recovery rate of 94.04% and an effective rate of 90.79%. Among the respondents, 1445 were male (66.3%) and 734 were female (33.7%). In terms of grade distribution, 314 were first-year students (14.4%), 423 were second-year students (19.4%), 595 were third-year students (27.3%), and 848 were fourth-year students or above (38.9%). Regarding the duration of entrepreneurial education, 723 students (33.2%) had received more than 6 months, 939 students (43.1%) had received 3–6 months, and 516 students (23.7%) had received less than 3 months of entrepreneurial education.

Instrumentation. This study selected educational capital, entrepreneurial practical training, entrepreneurial performance, and social support as the initial variables for the questionnaire. The questionnaire consisted of two parts: the first part was related to the respondents' demographics, objectives of the questionnaire, and entrepreneurial status of the respondents; the second part was the main body of the questionnaire, including four scales for educational capital, entrepreneurial practical training, social support, and entrepreneurial performance, respectively, with a total of 65 items. The educational capital scale was adjusted from Noel and Finocchio (2022) and covered human capital, psychological capital, and social capital, consisting of 31 items, for instance, "I can receive human capital support from society (human capital)", "I have a certain level of psychological resilience (psychological capital)", and "I have a broad network of social connections (social capital)". The entrepreneurial practical training scale was adapted from Maritz and Brown (2013) and consisted of 16 items, for example, "Through practical teaching, I can effectively identify opportunities." The entrepreneurial performance scale was adapted from Alqahtani et al. (2022) and contained 15 items, such as "The net profit of my company has significantly increased over the past year". The social support scale was adapted from Li et al. (2023) and consisted of 5 items, for instance, "During the entrepreneurial process, I am able to receive emotional comfort and encouragement from family and friends". All scales used a five-point Likert scale, with higher scores indicating a higher positive perception of the observed variable. The average value method was used to calculate the observed variables.

Data analysis. This study used SPSS 25.0 and AMOS 24.0 for statistical analysis. SPSS 25.0 software was used for descriptive statistics and correlation analysis of the variables. AMOS 24.0 software and the maximum likelihood method were used to fit, revise, and optimize the hypothesized model, constructing a standard model of the impact of educational capital on college students' entrepreneurial performance. Finally, the bootstrap analysis method was used to test the mediating effect of entrepreneurial practical training and the moderating effect of social support, exploring the mechanism of how educational capital affects entrepreneurial performance.

Common method bias and test of reliability and validity. To detect the impact of common method bias, Harman's single-factor test was used. The results of factor analysis showed that the first principal component accounted for 30.42% of the variance,

which did not exceed the threshold of 40%. Confirmatory factor analysis, by setting the number of common factors to 1, showed that the model fit indices met the requirements for common method bias testing (RMSEA = 0.143, $\chi^2/df = 715.2$, TLI = 0.551, CFI = 0.621, SRMR = 0.099), indicating that the sample data passed the common bias test. As for the reliability and validity of the research variables in this study, the results showed that the Cronbach's alpha coefficients for human capital, psychological capital, and social capital of educational capital were 0.910, 0.908, and 0.926, respectively; for financial performance, growth performance, and innovation performance of entrepreneurial performance were 0.855, 0.879, and 0.916, respectively; for entrepreneurial opportunity recognition, entrepreneurial resource acquisition, entrepreneurial team building, and entrepreneurial strategy planning of entrepreneurial practical training were 0.877, 0.891, 0.907, and 0.913, respectively; and for social support was 0.905. The corresponding fit indices for confirmatory factor analysis were within acceptable ranges, indicating good reliability and validity of the sample data and confirmatory factors.

Results

Descriptive statistics and correlation analysis. As shown in Table 1, the overall levels of educational capital, entrepreneurial practical training, and entrepreneurial performance were above average, indicating that entrepreneurial college students rated the value effects of human capital, psychological capital, and social capital brought by entrepreneurial education, the quality of entrepreneurial practical training, and overall entrepreneurial performance at a relatively high level. Psychological capital received the highest evaluation, being considered "highly open" and "cultivable" in similar studies (Luthans et al. 2008). Among the three types of educational capital, social capital received the lowest valuation. Although social capital positively influences factors like entrepreneurial intention, this study revealed that its value was the lowest compared to psychological and human capital, which, to some extent, reflected the disappointment among these students regarding the insufficient social capital value derived from entrepreneurship education. The evaluation of financial, growth, and innovation performance successively increased and converged towards the Kirznerian worldview. One plausible reason for this is that entrepreneurial opportunities in the market were not timely and fully exploited, resulting in a delayed manifestation of financial performance (Stratos 2021). Additionally, correlation analysis results showed significant positive correlations between the various dimensions of educational capital, entrepreneurial practical training, and entrepreneurial performance ($p < 0.01$), and the most significant correlation (0.83) was observed between growth performance and strategic planning, whereas the least significant correlation (0.42) was found between social support and psychological capital, providing preliminary support for the hypothesis testing research.

Model fit. Based on the reliability and validity tests and correlation analysis, the AMOS 24.0 software was used to fit the hypothetical model (initially without considering the moderation effect) to explore the causal relationships between latent variables. The fitting results showed that all paths were significant ($p < 0.05$), and the model fit indices were within acceptable ranges ($\chi^2/df = 4.57$, RMSEA = 0.078, TLI = 0.959, CFI = 0.969, SRMR = 0.018), indicating that the hypothetical model passed the test and had high explanatory power, acceptable for subsequent analysis.

The model fitting results are shown in Fig. 2. The variables in the model explained 71% of the variance in entrepreneurial performance ($R^2 = 0.71$), indicating statistical significance and that the hypothetical model constructed in this study had high explanatory power and was suitable for assessing the relationship between entrepreneurial educational capital and entrepreneurial performance.

As shown in Fig. 2, the three types of educational capital (human capital, psychological capital, and social capital) had a positive impact on entrepreneurial performance (EP). Different types of educational capital also had a positive impact on entrepreneurial practical training (ET). Meanwhile, entrepreneurial practical training (ET) positively impacted entrepreneurial performance (EP). Thus, hypotheses H1 (including H1a, H1b, H1c) and H2 (including H2a, H2b, H2c, H2d) were validated in this study, and this finding resonates with the viewpoints expressed by scholars such as Stam et al. (2014).

Testing the multiple mediation effects. To verify the significance of the multiple mediation effects of entrepreneurial practical training, a bootstrap analysis (with 5000 samples) was conducted using AMOS 24.0. The analysis results are shown in Table 2.

As shown in Table 2, the research model satisfied the mediation effect tests in the four paths: [EC → OI → EP] (Educational Capital → Opportunity Identification → Entrepreneurial Performance), [EC → AR → EP] (Educational Capital → Resource Acquisition → Entrepreneurial Performance), [EC → TB → EP] (Educational Capital → Team Building → Entrepreneurial Performance), and [EC → SP → EP] (Educational Capital → Strategic Planning → Entrepreneurial Performance). The *p*-values for the four paths are significant, and the confidence

Table 1 Descriptive statistics and correlation analysis outcomes.

	M	SD	HC	PC	SC	OI	AR	TB	SP	FP	GP	IP	SS
HC	3.79	0.61	**0.77**										
PC	3.84	0.66	0.74**	**0.82**									
SC	3.72	0.62	0.74**	0.78**	**0.80**								
OI	3.69	0.65	0.62**	0.62**	0.65**	**0.78**							
AR	3.66	0.63	0.61**	0.62**	0.62**	0.66**	**0.77**						
TB	3.62	0.61	0.64**	0.64**	0.64**	0.68**	0.68**	**0.79**					
SP	3.71	0.59	0.63**	0.65**	0.66**	0.66**	0.69**	0.67**	**0.85**				
FP	3.35	0.63	0.72**	0.75**	0.77**	0.69**	0.71**	0.70**	0.81**	**0.84**			
GP	3.51	0.58	0.75**	0.77**	0.78**	0.69**	0.70**	0.70**	0.83**	0.82**	**0.86**		
IP	3.62	0.64	0.74**	0.79**	0.79**	0.68**	0.69**	0.70**	0.81**	0.81**	0.82**	**0.71**	
SS	2.83	0.52	0.45**	0.42**	0.43**	0.43**	0.46**	0.44**	0.46**	0.55**	0.51**	0.48**	**0.77**

The bold values in the diagonal represents the square root of the average variance extracted.
HC human capital, *PC* psychological capital, *SC* social capital. *OI* opportunity identification, *AR* acquisition resource, *TB* team building, *SP* strategic planning, *FP* financial performance, *GP* growth performance, *IP* innovation performance, SS social support.
**$p < 0.01$.

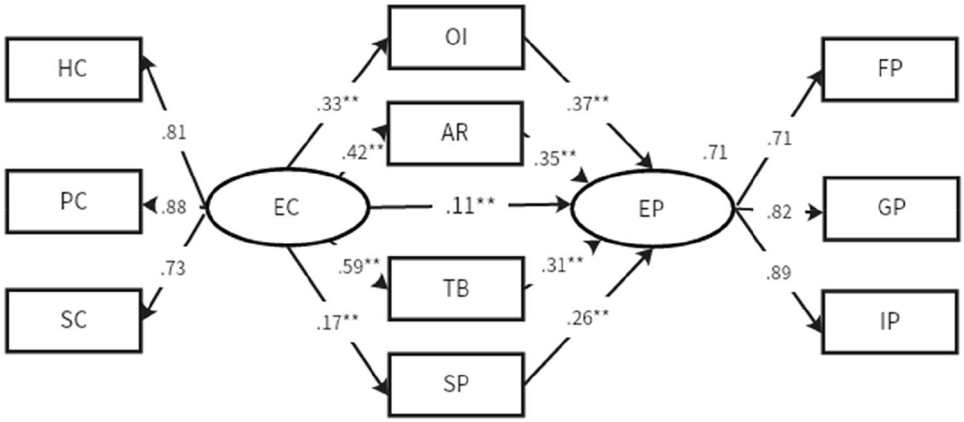

Fig. 2 Multiple mediation effect model without moderation.

Table 2 Bootstrap test of multiple mediation effects.

Path	Effect size	Boot SE	*Z*	*p*	Bias-corrected 95% CI		Effect proportion
					Lower	Upper	
Total effect	0.602	0.025	27.72	**	0.618	0.656	
Direct effect	0.109	0.012	9.08	**	0.093	0.121	18.11%
Indirect effect	0.493	0.022	26.55	**	0.479	0.524	81.89%
EC → OI → EP	0.121	0.013	9.31	**	0.101	0.138	20.10%
EC → AR → EP	0.146	0.018	8.11	**	0.134	0.161	24.25%
EC → TB → EP	0.182	0.015	12.13	**	0.167	0.196	30.23%
EC → SP → EP	0.044	0.016	8.44	**	0.035	0.051	7.31%

**$p < 0.01$

intervals do not include zero, indicating that entrepreneurial practical training (ET) has mediation effects in the relationships between the independent variable (i.e., Educational Capital) and the dependent variable (i.e., Entrepreneurial Performance). Thus, hypothesis H3 (including H3a, H3b, H3c, H3d) was validated, and it confirmed the perspectives advanced by scholars such as Kucel et al. (2016). All four mediation effects were partial mediation effects, with effect proportions of 20.10%, 24.25%, 30.23%, and 7.31%, respectively, with the mediation effect of [EC → TB → EP] being the highest.

Testing the moderation effect. To test the moderation effect of social support in the multiple mediation effect of educational capital on entrepreneurial practical training, the interaction term between educational capital and social support was included in the structural equation model. The hypothesized model shown in Fig. 1 (considering the moderation effect) was refitted. The results showed that the path "Educational Capital (EC) * Social Support (SS)" to entrepreneurial performance was not significant, so hypothesis H4 was not supported. And this research found inconsistencies with Hongbing and Finance (2014) perspective, which posited that the direct influence of educational capital on entrepreneurial performance is relatively modest, and further observed that social support does not moderate this direct relationship. After removing this moderation effect path, the refitted model showed that all paths were significant ($p < 0.05$), and the model fit indices were within acceptable ranges ($\chi^2/df = 4.54$, RMSEA = 0.078, TLI = 0.947, CFI = 0.961, SRMR = 0.036). The model's explanatory power for entrepreneurial performance increased to 73% ($R^2 = 0.73$), indicating statistical significance. The model fitting results are shown in Fig. 3.

As shown in Fig. 3, social support positively moderates the mediation effects in the paths "Educational Capital → Opportunity Identification / Acquisition Resource / Team Building → Entrepreneurial Performance" (path coefficients: $\beta1 = 0.17$, $p < 0.01$; $\beta2 = 0.23$, $p < 0.01$; $\beta3 = 0.11$, $p < 0.01$). However, social support negatively moderated the path "Educational Capital → Strategic Planning → Entrepreneurial Performance" ($\beta4 = -0.10$, $p < 0.05$), partially validating hypothesis H5. Specifically, H5a, H5b, and H5c were validated, but H5d was not. These findings align with the perspective advanced by Krueger et al. (2000). The negative moderation effect of the path "Educational Capital → Strategic Planning → Entrepreneurial Performance" suggested that the social entrepreneurial system associated with social support had significant conceptual differences from the entrepreneurial education path of universities regarding strategic planning. This difference implied the divergence in the strategic planning paths between student entrepreneurs and social entrepreneurs.

Table 3 compares the multiple mediation effects before and after introducing the moderation effect of social support. As shown in Table 3, under the moderation of social support, the total effect of educational capital on entrepreneurial performance increased from 0.602 to 0.684, a growth rate of 13.62%, indicating a significant moderation effect. The indirect effect increased from 0.493 to 0.580, a growth rate of 17.65%, and its proportion also increased from 81.89% to 84.80%. The mediation effects of "Educational Capital → Opportunity Identification/Resource Acquisition/Team Building → Entrepreneurial Performance" were significantly enhanced, with growth rates of 25.62%, 30.14%, and 11.54%, respectively, while the mediation effect of "Educational Capital → Strategic Planning → Entrepreneurial Performance" decreased from 0.044 to 0.035, a reduction of 20.45%. Due to the nonsignificant moderation effect of social support on the direct path of "Educational Capital → Entrepreneurial Performance," the change in direct effect was minimal, but its proportion decreased

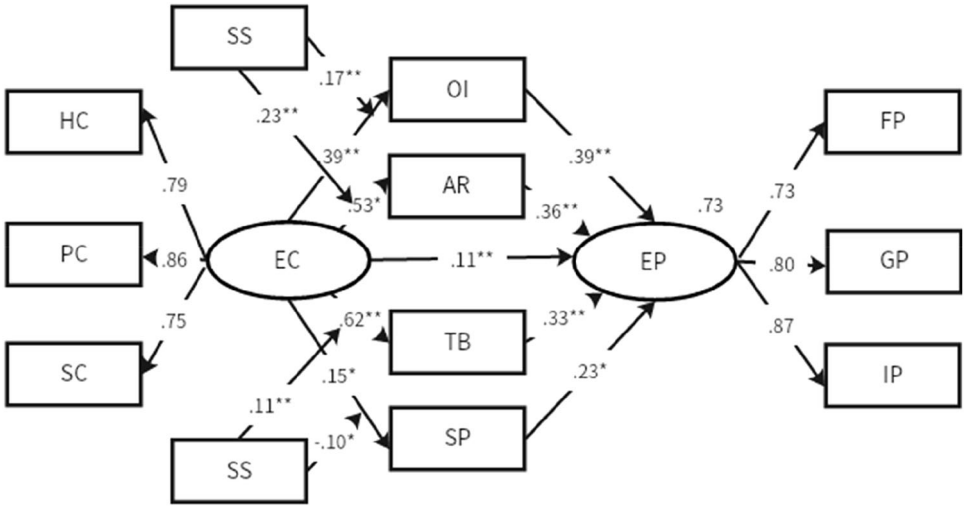

Fig. 3 Mediated multiple moderation effect model.

Table 3 Comparison of multiple mediation effects before and after moderation analyses.

Path	Before		After		Rate of increase
	Effect	Proportion	Effect	Proportion	
Total effect	0.602		0.684		13.62%
Direct effect	0.109	18.11%	0.104	15.20%	−4.59%
Indirect effect	0.493	81.89%	0.580	84.80%	17.65%
EC → OI → EP	0.121	20.10%	0.152	22.22%	25.62%
EC → AR → EP	0.146	24.25%	0.19	27.78%	30.14%
EC → TB → EP	0.182	30.23%	0.203	29.68%	11.54%
EC → SP → EP	0.044	7.31%	0.035	5.12%	−20.45%

from 18.11% to 15.20%, influenced by other mediation effects. Evidently, social support exerted varying degrees and even opposite directions of moderation effects on different paths of "Educational Capital → Entrepreneurial Practical Training," indicating the complexity of the mechanism by which social support influenced entrepreneurial education.

Discussion

By integrating previous theoretical and empirical research findings, this paper established a multi-mediation model to explore the impact of educational capital on entrepreneurial performance and examined the internal value conversion and external performance realization issues of entrepreneurial educational capital. The results indicate that the overall effect of educational capital endowed by entrepreneurial education was at an upper-middle level. Among the various effects of educational capital, psychological capital was rated the highest, followed by human capital and social capital. This finding largely aligns with Luthans et al. (2010), who found that psychological capital had a relatively higher-order impact on entrepreneurs' job performance and satisfaction (Luthans et al. 2010). This further elucidated how psychological capital influenced the crucial decisions individuals made concerning the establishment and management of new enterprises (Forbes 2017).

This study confirms that educational capital has a direct empowering effect on entrepreneurial performance, positively influencing performance outcomes. It also confirms that the four dimensions of entrepreneurial training serve as partial mediators between educational capital and entrepreneurial performance, with effect values of 0.121, 0.146, 0.182, and 0.044, respectively. Additionally, it demonstrates that educational capital exhibits a chained accumulation effect on entrepreneurial performance expression. Moreover, the study verifies that social support moderates the path from educational capital to the dimensions of entrepreneurial training. The moderating effect is positive for the dimensions of opportunity identification, acquisition of entrepreneurial resources, and entrepreneurial team building, with the most significant effect on acquisition of resources, consistent with prior research findings that social support positively moderates the conversion of capital to performance in startups (Shao et al. 2022).

The impact of different educational capitals. Previous research has highlighted the antecedent effects of psychological capital and the mediating role of opportunity identification (Newman et al. 2014). Studies have also found that human capital, social capital, and psychological capital have significant positive impacts on job satisfaction and innovation performance (Simons and Buitendach 2013). Generally, entrepreneurs with higher psychological capital are predicted to have stronger motivation to achieve entrepreneurial goals (Larson and Luthans 2006). Psychological capital plays a crucial role in realizing entrepreneurial performance. On one hand, enhancing psychological capital helps boost the confidence and self-efficacy of student entrepreneurs, stimulating their intrinsic motivation to participate in entrepreneurial activities. On the other hand, psychological capital can positively influence the accumulation and development of human and social capital, thereby promoting the overall value of educational capital.

However, the intense focus on psychological capital might also expose some issues. The previous entrepreneurship education tended to overly concentrate on shaping and stimulating students' entrepreneurial ideals, intentions, and motivations at the psychological level, whereas the cultivation of social capital, including connecting with market realities, establishing business networks, and accumulating practical experience, was relatively neglected. Furthermore, adequate measures to enhance the human capital of entrepreneurial college students were still lacking. Although the enhancement of human capital grounded in entrepreneurial ability was regarded as a crucial benefit of entrepreneurship education for such students (Ashourizadeh et al. 2022; Saeedikiya et al. 2021; Saeedikiya et al. 2024), it potentially resulted in inefficient input and transformation of social and human capital, manifesting as a notable flaw in the internal circulation of entrepreneurship education capital.

Therefore, while emphasizing the construction of psychological capital, entrepreneurial education should also strengthen the

cultivation and conversion mechanisms of social and human capital, ensuring students not only possess strong psychological resilience but also solid social networks and practical experience, ultimately achieving comprehensive and multi-level value addition to educational capital and significantly enhancing entrepreneurial performance among university students.

The mediating role of entrepreneurial training. The Theory of Planned Behavior posited that behaviors not fully governed by individual will are influenced not solely by behavioral intentions, but also by actual control conditions, including individual abilities, opportunities, and resources necessary for behavior execution. The findings of this study echoed this perspective, indicating that the conversion of entrepreneurial college students' educational capital into entrepreneurial performance is constrained by their control conditions, specifically their ability to identify entrepreneurial opportunities and utilize resources. This study found that the four dimensions of entrepreneurial training partially mediated the relationship between educational capital and entrepreneurial performance. The overall evaluation of latent variables such as the effect of educational capital, entrepreneurial training, entrepreneurial performance, and social support showed a declining trend, with scores of 3.78, 3.67, 3.49, and 2.83, respectively. A possible explanation is that the educational capital from entrepreneurial education has not significantly translated into students' entrepreneurial performance. This aligns with the findings of Fayolle and Gailly (2008) that entrepreneurial education needs a more scientific evaluation approach to enhance its effectiveness in translating into entrepreneurial performance.

Despite entrepreneurial team building being rated lowest among the four dimensions of entrepreneurial training, its mediating effect on entrepreneurial performance is the highest (with effect value of 0.181, accounting for 30.23%). Team building occupies a central role in entrepreneurial training, especially in efficiently converting educational capital into entrepreneurial performance. This suggests that entrepreneurial education should not only focus on individual entrepreneur capacity building but also emphasize comprehensive team-level skills such as teamwork spirit, resource allocation, and coordination, ensuring each member performs optimally and collectively drives the success and sustainable development of entrepreneurial projects. Therefore, in designing and implementing entrepreneurial education, team building should be a focal point, utilizing targeted courses, practical simulations, and cooperative projects to cultivate students' teamwork and management abilities, thereby efficiently converting educational capital in the dimension of team building and ultimately enhancing the overall entrepreneurial performance.

The moderating role of social support. This study confirmed that social support moderated the path from educational capital to entrepreneurial training, but this moderating effect is not comprehensive. Unlike the positive moderating effects on opportunity identification, resource acquisition, and team building, social support negatively moderated the path from educational capital to entrepreneurial strategic planning. This might be because, although social support positively impacts specific practical aspects of entrepreneurial training, there is a significant divergence between the social support forces and the university entrepreneurial education system regarding high-level entrepreneurial talent cultivation and macro strategic planning. This highlights the disparity between academic theories and social practices in entrepreneurial education (Izedonmi and Okafor 2010).

In entrepreneurship education, the academic theoretical community, represented by universities, typically prefers a "theory-before-practice" model (Provasnek et al. 2017), emphasizing systematic learning of foundational knowledge and professional skills before engaging in entrepreneurial activities. In contrast, practitioners, represented by investment institutions, advocate for "learning by doing" in entrepreneurship (Colombelli et al. 2022), encouraging students to participate directly in societal entrepreneurial practices to gain insights and skills from real market environments and entrepreneurial processes. Both entrepreneurial education models have their merits. To bridge the gap between them and enhance overall effectiveness, it is necessary to promote mutual learning and integration between academic entrepreneurial education and social entrepreneurial education. This interaction and complementarity among different entrepreneurial education philosophies, models, and groups can ensure that entrepreneurial education cultivates entrepreneurs with a solid theoretical foundation and strategic vision and teaches students to flexibly respond to market changes and adapt quickly to the entrepreneurial environment, ultimately achieving the effective conversion of educational capital into entrepreneurial performance.

Strategies and suggestions

More than ever before, it is urgent to develop a comprehensive understanding of the dynamic aspects of entrepreneurial activities and education, including their various forms, the involved processes, the venture, and the resulting outcomes (Kuratko et al. 2015). One major challenge in implementing entrepreneurial education is balancing the tension between educational orientation and market orientation. The educational aspect focuses on constructing an internal knowledge system and the endogenous growth of innovative value (inside-out processes), while the market aspect emphasizes the effective integration of external resources and the sensitive alignment with market demand (outside-in processes; Volkmann et al. 2010). To enhance university students' entrepreneurial performance, a synergistic remodeling mechanism that combines these two value orientations is necessary.

From the perspective of the flow and conversion of educational capital, this study analyzed the structural constraints behind the poor entrepreneurial performance of university students. The research indicated that by innovating the entrepreneurial education system, advocating systematic reform, and strengthening the interaction and collaboration between educational entities and stakeholders such as government, enterprises, and social groups, it is possible to promote the internal and external interaction of multiple forms of educational capital, including social, human, and psychological capital. To advance entrepreneurial education to a higher quality development stage and achieve a deep integration of education, technology, and talent resources, the following strategic directions should be emphasized in entrepreneurial education reform.

Promoting the development of high educational capital to leverage its positive role in fostering entrepreneurial performance. This study robustly confirmed the critical influence of educational capital in enhancing entrepreneurial performance, reflected not only in the capital discovery and empowerment processes within the entrepreneurial education system but also in the broad realm of external resource allocation and information exchange. This aligns with related research conclusions that human, psychological, and social capitals are positively correlated and significantly impact task performance and contextual performance (Xu et al. 2022). In this regard, entrepreneurial education holds dual core values for university student entrepreneurs.

First, entrepreneurial education lays a solid foundation for the initial accumulation and startup phase of entrepreneurial capital (i.e., from 0 to 1). Systematic entrepreneurial education, through carefully designed curricula and processes, enhances and

empowers students' entrepreneurial knowledge, skills, and capabilities. During this process, entrepreneurial education should closely integrate with psychological education, specifically strengthening the psychological quality of entrepreneurial students. Additionally, leveraging mechanisms such as university entrepreneurial competitions can consolidate and enhance the human and social capital of student entrepreneurs, forming long-term effects in cultivating innovative and entrepreneurial talents.

Second, entrepreneurial education also provides a stage for practice exercises during the expansion and fission phase of entrepreneurial capital (i.e., from 1 to *N*). By creating a favorable campus entrepreneurial environment and practical opportunities, students are encouraged to actively engage in teamwork and simulate real entrepreneurial scenarios. This allows them to continually enhance themselves in real-world resource exchanges, information interactions, and team collaborations, embodying Dewey's principle of "learning by doing." Essentially, the significance of educational capital in entrepreneurial education lies in its role as a widely recognized value scale that facilitates internal resource exchange and external promotion. This value can only be fully realized through dynamic interaction.

Enhancing entrepreneurial training and practice to bridge the gap between on-campus and off-campus entrepreneurial organizations. This study confirms that the four dimensions of entrepreneurial training (opportunity identification, resource acquisition, team building, and strategic planning) play multiple mediating roles between educational capital and entrepreneurial performance. This indicates that entrepreneurial training is an important educational carrier for the capital to performance transformation. However, the research also finds that the overall capital conversion efficiency of entrepreneurial training is less than ideal, with a gradual decline in the conversion process from educational capital to entrepreneurial performance. Additionally, there are fragmented and disconnected aspects among different modules and stages of entrepreneurial education implementation.

To address these issues, entrepreneurial training should be the main axis for comprehensively deepening the reform of the entrepreneurial education system. First, the awareness of opportunity identification among university students should be heightened. Entrepreneurial education should adhere to both educational and market principles, with mentors guiding students to directly and proactively engage in social entrepreneurial practices. This involves capturing opportunities and understanding market rules through the experience of market competition, with a particular emphasis on hands-on teaching, practical operations, and real-world training, avoiding the pitfalls of abstract, theoretical-only entrepreneurship education.

Second, a fair competition incentive mechanism should be established. Competition is the essence of a market economy, and entrepreneurial education should avoid fostering a dependency mindset through excessive support. Instead, it should encourage students and faculty to actively participate in the local entrepreneurial investment and financial equity investment competition systems, thus promoting a spirit of fair competition for educational capital and entrepreneurial resources.

Third, the spirit of teamwork and collaboration should be emphasized. This research confirms that teamwork has a higher mediating effect in the conversion of capital. Therefore, entrepreneurial education should not only focus on developing students' organizational and leadership abilities but also on their teamwork spirit and collaborative skills. Through diverse organizational methods such as project incubation, team building, and event exchanges, students' holistic perspectives, cooperative attitudes, and service spirits can be cultivated.

Finally, improving university student entrepreneurs' strategic vision is essential. Entrepreneurial education should be based on the rational perception, behavior feedback of students in the learning process (Mwasalwiba 2010) and promote a deep integration of entrepreneurship education with professional education. Students should be encouraged to engage more actively in emerging fields such as international entrepreneurship, social entrepreneurship, and technological entrepreneurship, thereby enhancing the sustainability and added value effects of entrepreneurial education.

Leveraging social organizations as stakeholders in synergistically nurturing entrepreneurial talents. This study further confirmed the complex moderating function of social support in the path from educational capital to entrepreneurial training, showing its significant role in promoting entrepreneurial education. This aligns with related research conclusions that entrepreneurial education systems need to be more closely integrated with social support to improve the success rate of entrepreneurial activities (Nicolaou et al. 2009). However, in practice, the deep integration and efficient linkage mechanism between social support and entrepreneurial education have not been fully established, which directly or indirectly limits the role of social support. To solve this problem, innovative approaches in the way social support intervenes in entrepreneurial education and their linkage mechanisms are needed.

First, the access mode of social support in entrepreneurial education should be improved. Social forces supporting entrepreneurial education should not be limited to extracurricular guidance, event sponsorship, and experience sharing, but should be encouraged to participate more actively and comprehensively in the entire process of entrepreneurial education, especially in the talent cultivation stage. Efforts should be made to eliminate the barriers between university entrepreneurial education and regional innovation and entrepreneurship systems, promoting the deep integration and complementary advantages of social entrepreneurial resources and campus entrepreneurial teams. Combining mature enterprise projects with campus startups through deep cooperation between industry and academia can achieve precise matching and seamless connection between social support and entrepreneurial education.

Secondly, continuously optimizing the collaborative coordination mechanism between social entrepreneurial organizations and university entrepreneurial education institutions is crucial. We should actively explore the creation of cross-regional, cross-industry, and cross-school entrepreneurial education curriculum systems, practical training platforms, and public service networks, leveraging the advantages of industry-education integration to highlight the academic characteristics of universities while incorporating social media feedback and commercial entity participation. Furthermore, we should incorporate diverse evaluation indicators such as academic assessments, competition outcomes, educational research outputs, and actual entrepreneurial achievements into unified considerations to design a scientifically reasonable evaluation scheme for the transformation of educational capital and the realization of entrepreneurial performance. Through close interaction and shared construction of internal and external entrepreneurial resources, a vibrant and innovative entrepreneurial education consortium can be built to comprehensively enhance the quality and effectiveness of entrepreneurial education.

Limitations and future research directions

Limitations. First, this study is culturally and contextually specific, as it examines entrepreneurial students from universities in four Chinese provinces: Zhejiang, Fujian, Shandong, and

Guangdong. While the findings provide valuable insights into how higher education capital enhances entrepreneurial performance within this particular context, their generalizability to other cultural and educational settings remains limited. Entrepreneurial ecosystems and the role of education capital vary significantly across regions and cultures, influencing how students leverage their educational experiences for entrepreneurial success. To broaden the applicability of these findings, future research should explore these dynamics in diverse international contexts, comparing how different educational and entrepreneurial ecosystems shape similar relationships.

Second, the reliance on cross-sectional data presents a significant constraint, as data were collected at a single point in time through a survey. This approach limits the ability to establish causality or capture changes in educational capital and entrepreneurial performance over time. Without a longitudinal perspective, it remains unclear how educational capital evolves throughout an entrepreneur's journey and whether its influence fluctuates across different venture stages. Future studies should adopt longitudinal designs, which would allow researchers to track the temporal dynamics of education capital, assess long-term impacts, and validate the proposed mechanisms with greater robustness.

Third, the measurement of social support in this study was treated as a unitary construct, which may oversimplify its complex and multifaceted nature. Social support encompasses various dimensions, including emotional, instrumental, and informational support, each of which may exert distinct influences on entrepreneurial behavior and performance. By aggregating these dimensions into a single measure, this study may have overlooked potential variations in how different forms of support interact with educational capital. Future research should refine the measurement of social support by disaggregating it into its sub-dimensions, enabling a more nuanced exploration of its moderating role and providing deeper insights into targeted support strategies for entrepreneurial success.

Future research directions. First, cross-cultural comparisons are essential for validating and extending the findings of this study. Future research should examine how educational capital influences entrepreneurial performance across different cultural and educational environments, considering the mediating role of cultural factors. Comparative studies across countries with varying levels of economic development, educational systems, and entrepreneurial ecosystems could provide valuable insights into the broader applicability of the proposed model. Such studies would also help identify contextual factors that may strengthen or weaken the relationship between educational capital and entrepreneurial outcomes.

Second, the adoption of longitudinal research designs would significantly enhance the understanding of how educational capital develops and impacts entrepreneurial performance over time. By tracking changes in education capital across different entrepreneurial phases, researchers can better identify key inflection points where education capital plays a crucial role. Additionally, longitudinal data would allow for the application of advanced statistical techniques, such as panel data modeling and time-series analysis, to establish causal relationships and assess the stability of the proposed theoretical framework.

Third, future research should delve deeper into the sub-dimensions of social support, examining the distinct roles of emotional, instrumental, and informational support in shaping entrepreneurial outcomes. By differentiating these types of support, scholars can uncover how each contributes uniquely to entrepreneurial motivation, resilience, and decision-making. Furthermore, understanding the interactions between specific forms of social support and educational capital could lead to more effective interventions, ensuring that entrepreneurial students receive targeted resources that align with their needs. This refined approach could enhance the precision and effectiveness of policies and programs aimed at fostering entrepreneurial success.

Data availability

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to ethical restrictions related to participant confidentiality and consent.

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Author contributions

ZL: Conceptualization, methodology, writing—review and editing, funding acquisition; XTZ and XHW: Conceptualization, methodology, writing-original draft preparation; KJZ, TZ, JHZ, and TAA: Project administration, visualization, writing—review and editing. All authors have read and agreed to the published version of the manuscript. Xiaotong Zhi and Xinghua Wang are corresponding authors of this paper.

Competing interests

The authors declare no competing interests.

Ethical approval

This study was approved by the Institutional Review Board of Qingdao University (ID: QDU-HEC-2023267) in December 2023. All research was performed in accordance with the ethical principles outlined in the Declaration of Helsinki and relevant national guidelines. This IRB approval was limited to data collection through surveys and interviews.

Informed consent

Written informed consent was obtained from all participants before the survey administration in 2024. The consent detailed the necessity and scope of the survey study, data usage (academic use only), and consent to publish. All participants were fully informed of their anonymity, that their participation was voluntary, that all information collected during this study were kept confidential and stored securely.

Additional information

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Correspondence and requests for materials should be addressed to Xinghua Wang or Xiaotong Zhi.