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How does entrepreneurial curiosity stimulate new venture ideas among Chinese undergraduates? The mediating role of promotion focus and the moderating role of entrepreneurial education

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Abstract

Background New venture ideas denotes "imagined future ventures", which are vital for undergraduates' entrepreneurial success. As existing studies concentrating more on entrepreneurial opportunity, intention, and behavior, there remains a research gap in understanding how new venture ideas emerge. By integrating the broaden-and-build theory of positive emotions, the information-gap theory of curiosity, the regulatory focus theory and the regulatory fit theory, this study aims to explore how two different types of entrepreneurial curiosity (I-type entrepreneurial curiosity and D-type entrepreneurial curiosity) affect the undergraduates' new venture ideas through promotion focus, as well as the moderating effect of entrepreneurial education.

Methods With a sample of 650 undergraduates in Chinese universities through questionnaire star platform, this study employs a PLS-SEM to test hypotheses.

Results I-type curiosity, rather than D-type curiosity, has a positive effect on undergraduates' new venture ideas. Promotion focus plays a full mediating role in the effect of D-type entrepreneurial curiosity on new venture ideas, and a partial mediating role in the effect of I-type entrepreneurial curiosity on new venture ideas. In addition, entrepreneurial education positively moderates those mediating effects.

Conclusions This study elaborates on how entrepreneurial curiosity drives undergraduates' generation of new venture ideas. It proposes that Chinese universities can effectively foster new venture ideas by cultivating undergraduates' entrepreneurial curiosity and improving entrepreneurial education. The findings also offer practical advice for facilitating entrepreneurship.

Keywords I-type entrepreneurial curiosity, D-type entrepreneurial curiosity, New venture ideas, Entrepreneurial education, Promotion focus

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Introduction

Undergraduates, as the driving force for "mass entrepreneurship and innovation", have been given great importance by the Chinese government in terms of their entrepreneurship. For undergraduates, it is crucial to generate new venture ideas before starting their own business. Davidson (2015) argued that a new venture idea is an "imagined future venture", which represents what an individual wants to create, rather than the gradually materializing entrepreneurship itself [1]. In other words, new venture ideas are cognitive, and individuals can envision a new venture idea whether to take action or not. Over time, the idea may be developed and refined into an opportunity that be utilized, or it may not. If an idea is not developed, it will never become a viable opportunity [2]. Since it is difficult to verify the commercial value of entrepreneurial opportunities during undergraduates' short academic period, focusing on new venture ideas is more important and practical.

Up to date, how a new venture idea develops is still underexplored. As a key factor in entrepreneurial success, curiosity has gained increasing momentum in entrepreneurship research [3]. Researchers have confirmed that curiosity positively influences creativity by enhancing individuals' ability to explore and experiment in dynamic contexts [4, 5], which is critical in the formation of new venture ideas. Litman and Jimerson (2004) classified curiosity into I-type and D-type [6]. I-type curiosity refers to an individual's intrinsic knowledge-seeking motivation derived from interests, accompanied by a sense of pleasure after making new discoveries or acquiring new knowledge, which means "wanting to know". The broaden-and-build theory of positive emotions posits that positive emotions can broaden an individual's attentional focus and cognitive flexibility, enhance information processing efficiency, and facilitate the adoption of creative behaviours [7]. D-type curiosity emerges when perceived uncertainty and novelty disrupt individuals' original cognitive coherence in their brain, with an uncomfortable sense of deprivation, which is the "need to know" [8]. The information-gap theory of curiosity suggests that when individuals recognize a gap in their knowledge and understanding, curiosity is triggered, which drives them to actively seek out new information [9]. Therefore, two types of curiosity may contribute to new venture ideas by stimulating exploration. Furthermore, the regulatory focus theory holds that, individuals with promotion focus are willing to innovate, enjoy taking risks, try and explore new things [10]. Thus, in entrepreneurship, promotion focus may be a key factor mediating the impact of entrepreneurial curiosity on new venture ideas.

In recent years, scholars have conducted valuable researches about new venture ideas, including its concept, formation stages, antecedents, and evaluation methods [1, 2, 11–13]. However, it has received less attention compared to entrepreneurial opportunity and entrepreneurial intention among undergraduates, because these variables are more directly related to entrepreneurial behavior itself. And the definition of new venture ideas has not been widely or accurately recognized; some studies even confuse it with the entrepreneurial concepts mentioned above. In addition, there is a lack of empirical research on the formation mechanism of new venture ideas. Previous studies have introduced curiosity into the field of entrepreneurship, mainly focusing on the role of curiosity in creativity — especially in creative thinking tasks [14], creative personality [15], and creative achievement [16]. But "new venture ideas" differs from these creativity-related variables in that it emphasizes the quantity of ideas rather than their quality. To fill the gap in existing research, this study takes "new venture ideas" as the outcome variable, and explores the predictive effects of two types of entrepreneurial curiosity on new venture ideas based on the broaden-and-build theory of positive emotions and the information-gap theory of curiosity, respectively. To further enrich the research on the influence mechanism of entrepreneurial curiosity on new venture ideas, this study introduces promotion focus as a mediator variable based on the regulatory focus theory and entrepreneurial education as a moderator variable based on the regulatory fit theory.

Entrepreneurial curiosity and new venture ideas

Entrepreneurial curiosity is an independent type of curiosity exclusively focused on the field of entrepreneurship [17], which can be understood as an internal desire for entrepreneurial information. It specifically refers to epistemic curiosity, which was defined as an emotional-motivational state of individuals [18]. According to classification of epistemic curiosity [6], entrepreneurial curiosity in this study is also divided into two types: I-type entrepreneurial curiosity that derives from interests, and D-type entrepreneurial curiosity originates from the pursuit of cognitive coherence in the brain [8]. While individuals with I-type entrepreneurial curiosity have a natural sense of joy and excitement towards innovative things [6], D-type curiosity is an important antecedent for the formation of negative emotions such as anger, worry, and anxiety before deprivation is eliminated [19]. The different feelings accompanying the two types of curiosity can be explained by the optimal-level model and the driven theory of curiosity, respectively [20].

Optimal-level theorists propose that curiosity induction is beneficial, involving feelings of interest rather than uncertainty [21–24], in which the curiosity is I-type curiosity. As a positive emotion, I-type entrepreneurial curiosity closely related to interest with the desire to

investigate, learn, and participate in new experiences [25], which contributes to generate new venture ideas. The broaden-and-build theory of positive emotions holds that positive emotions broaden the scope of attention and thought-action repertoires. Specifically, positive emotions can extend people's thinking first, "opening up our hearts and minds, making us more receptive and creative"—this is the expansion function. Then, they can also "build the best future". "positive emotions enable us to discover and construct new skills, relationships, knowledge, and production methods"—this is the construction function [7]. Studies have confirmed that positive emotions are beneficial for stimulating creativity, manifested in effects such as affecting the organization of cognitive materials, increasing the tendency to combine materials in new ways, and finding correlations between different stimuli [26–28]. Gasper and Clore (2002) also discovered that, compared to positive emotions that make people pay more attention to the forest, negative emotions make people "see the trees but not the forest" [29]. Curiosity and other positive emotions, such as interest and wonder, play an important role in the pursuit of scientific ideas [30].

Contrary to the optimal-level account, driven theorists equated curiosity with relatively unpleasant "uncertain experiences", and reducing it is beneficial [31, 32], which referred to D-type curiosity. Research has found that, when faced with uncertainty, individuals with curiosity often demonstrate a strong willingness to learn and actively engage in learning, which helps them get more heterogeneous information and knowledge [33]. They often invest a lot of time in activities they focus on, collecting and processing information deeply, and are more likely to persist until achieving their goals [34]. Curiosity also leads individuals to think about tasks from new perspectives, transforming threats posed by uncertainty into challenges, which is greatly beneficial for creative thinking [35]. Thereafter this curiosity-driven shift in thinking stimulates the generation of creative ideas [36]. Moreover, by triggering information searching, curiosity helps individuals identify and define problems that need to be addressed, which are critical to generate creative ideas [5].

Promotion focus as a mediator

Another factor that affects new venture ideas is promotion focus. The regulatory focus theory proposes that individuals gradually develop two distinct and relatively stable self-regulatory focus tendencies during their growth, including promotion focus and prevention focus [37]. Promotion focus represents a proactive motivational orientation characterized by (a) an inherent drive for growth and advancement, (b) a tendency to employ active coping styles, and (c) the manifestation of positive responses to stressful events [38–40]. Individuals with promotion focus tend to maintain aggressive motivation and pay more attention to positive results, and then adopt a relatively adventurous strategy [41]. Although self-regulatory focus tendency is relatively stable, it may also be influenced by the current situation or task, thus showing a temporary motivational orientation [42].

Prior research has examined the relationship between promotion focus and new-ideas-related variables, revealing that under the guidance of promotion focus, individuals are more focused on processing exploratory information, resulting in more creative ideas [43]. Individuals with promotion focus have strong achievement motivation which can enhance their alertness, thereby encouraging them to constantly pursue new ideas [44]. They have a stronger propensity to undertake proactive behaviors [45], seek opportunities actively and extensively, which leads to generate more hypotheses about potential opportunities [46, 47]. Promotion focus can also compensate for entrepreneurs' low level of creative self-efficacy and entrepreneurial self-efficacy [48]. By activating positive emotional arousal and enhancing individual cognitive flexibility, it fosters conditions beneficial for creativity [49, 50]. Based on the regulatory focus theory, Brockner et al. (2004) explained the entrepreneurial process and found that strengthening promotion focus tendency can help generate potentially successful ideas [51].

As a self-regulatory attribute, curiosity helps individuals judge uncertainties as opportunities to approach and explore, rather than as threats to avoid [52], implying that curiosity may trigger one's promotion focus tendency. Curiosity can determine attention allocation and task priority, thus forming a mechanism for active learning and exploration [53], which helps individuals maintain positive exploratory behavior by enhancing attention [54]. Studies have shown that individuals with strong curiosity actively learn from others and foster self-directed exploration and innovative behavior [55, 56]. Moreover, curiosity supports creative achievement through positive judgments of novelty and an intrinsic motivation to approach instead of avoid uncertainty [57]. That's to say, promotion focus rather than prevention focus may be an important factor in the process by which curiosity affects the formation of new venture ideas.

As mentioned above, individuals with I-type curiosity or D-type curiosity are different in their reactions to novelty, but both serve to explore new knowledge and pursue positive outcomes, which align with the goals of growth, improvement, and development in promotion focus. Individuals with I-type curiosity often show positive emotions during their exploratory learning, such as joyful, and enhance their intrinsic motivation [58]. Since positive emotions convey a comfortable psychological

state, in which individuals are often more easily inspired and more willing to explore new things [59]. As one of the most representative positive emotions, interest stimulates individuals' cognitive and behavioral tendency to explore, which can help them continuously acquire knowledge and experience that are conducive to achieve goals [60]. D-type curiosity can be explained by the information-gap theory of curiosity, which suggests that curiosity emerges when individuals realize that there is an information gap in their knowledge and understanding. Due to internal pressure, they will hunt for new information to fill it [9]. That's to say, the sense of deprivation accompanied by D-type curiosity motivates and guides individuals to search for information, in order to reduce uncertainty and eliminate cognitive gaps [8]. In summary, compared to I-type curiosity that is associated with intrinsic motivation, D-type curiosity correlates with both intrinsic and extrinsic motivation, which stimulates individuals' uncertainty avoidance, specific exploration, information-search, and goal-oriented learning [61]. Lauriola et al. (2015) explored the relationship between epistemic curiosity and self-regulatory focus through two studies, and found that individuals with I-type curiosity always adopt approaches to learning that are funny, carefree and optimistic, while individuals with D-type curiosity tend to be more thoughtful and more cautious when searching knowledge [62].

Entrepreneurial education as a moderator

As discussed above, individuals with promotion focus are more likely to generate new venture ideas through proactive exploration. However, a key question is how promotion focus, caused by entrepreneurial curiosity, can be strengthened to intensify its effect on new venture ideas. Researchers have found that entrepreneurial education can effectively enhance undergraduates' understanding of entrepreneurial knowledge and skills, which are enable the construction of new connections and combinations that can be technically realized [63]. It's also helpful for individuals to understand data and forms that are novel, newly generated, and inconsistently patterned, guiding them to focus on the science, technology, and principle that contribute to produce creative ideas [64]. Canavati et al. (2021) categorized human capital into knowledge acquired through education and knowledge acquired through experience, which showed that individuals with higher levels of each type of knowledge perform better at generating new ideas than those with lower levels, and when individuals have higher levels of both types of knowledge, they do even better [65]. In addition, entrepreneurial education is closely related to individuals' ability to identify entrepreneurial opportunity [66]. High-level entrepreneurial education can improve the ability to identify entrepreneurial opportunity [67], which is closely related to new venture ideas. Thus, the formation of new venture ideas among undergraduates depends on the entrepreneurial education they have received.

The role of entrepreneurial education between the relationship of promotion focus and new venture ideas can be explained by the regulatory fit theory [68], which expands upon components from the regulatory focus theory. The regulatory fit theory suggests that when an individual's self-regulatory focus tendency (promotion vs. prevention) matches their behavioral strategy, a regulatory fit effect occurs, which can enhance the individual's motivation, subjective evaluation, and emotional experience in the process of goal pursuit [69]. The goal of entrepreneurial education in universities is to foster undergraduates' innovation awareness and entrepreneurial spirit, thereby the strategy of entrepreneurial education is to encourage undergraduates to be willing to explore, brave in innovation, and dare to take risks [58, 70]. It is clear that promotion focus is consistent the goals and strategies of entrepreneurial education. According to the regulatory fit theory, entrepreneurial education can strengthen the positive effect of promotion focus on new venture ideas. What's more, the indirect influence of entrepreneurial curiosity on new venture ideas becomes stronger among undergraduates who receive high-level rather than low-level of entrepreneurial education, because the universities with high-level entrepreneurial education usually provide more entrepreneurial support for their undergraduates and encourage them to display in entrepreneurship, which matches more with promotion focus tendency.

The present study

This study aims to explore how two types of entrepreneurial curiosity affect new venture ideas among undergraduates. From the above literature research, it can be seen that two types of entrepreneurial curiosity, promotion focus and new venture ideas are highly correlated. Moreover, entrepreneurial education can stimulate undergraduates' entrepreneurial exploration. Based on prior empirical findings, we formulated the theoretical model (showed in Fig. 1), and hypothesized as followings:

H1 I-type and D-type of entrepreneurial curiosity would positively predict new venture ideas.

H2 Promotion focus plays a mediating role in the relationship between two types of entrepreneurial curiosity and new venture ideas.

H3 Entrepreneurial education positively moderates the mediating effect of promotion focus on the relationship between two types of entrepreneurial curiosity and new venture ideas.

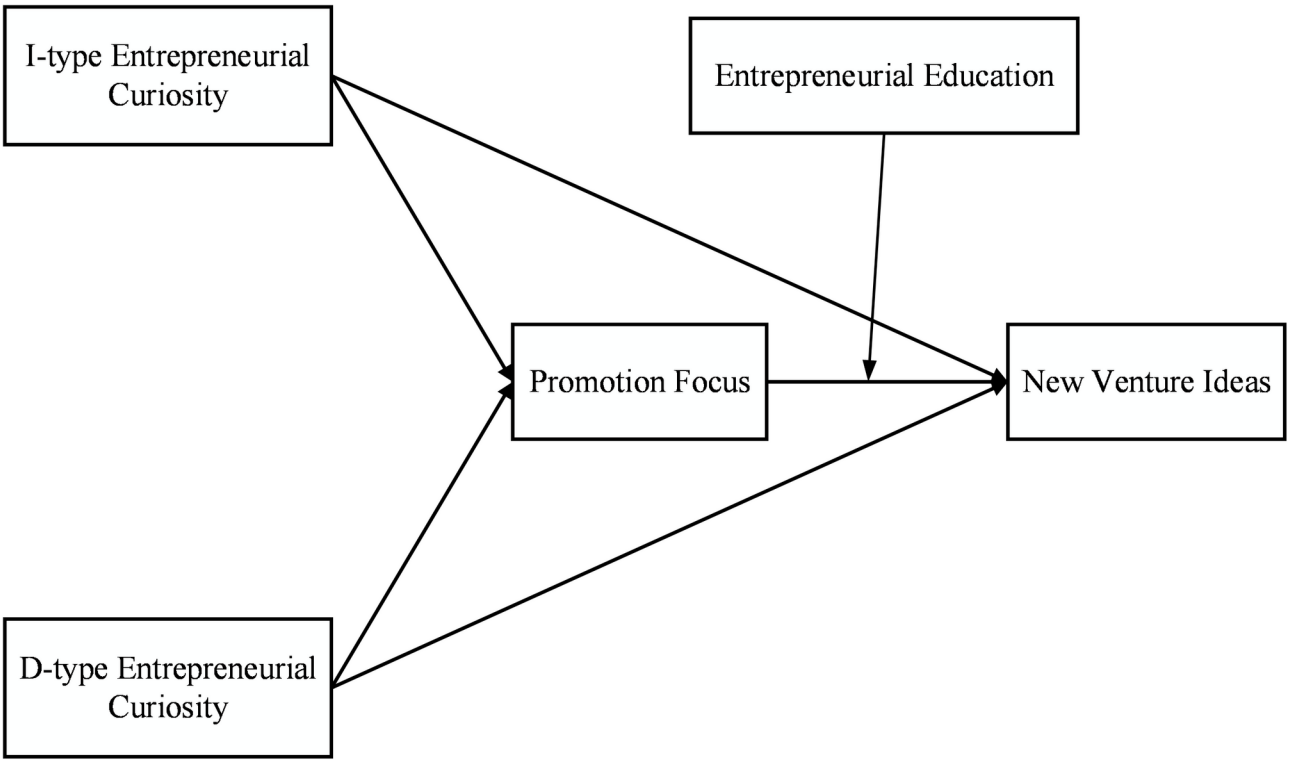

Fig. 1 The theoretical model

Methods

Sample

This study used an online survey to collect data from undergraduates in China by cluster sampling method. In the questionnaire, the first question was "Do you agree to fill in the survey?". If a respondent selected "disagree", the survey would skip to the end. A total of 760 questionnaires were returned through questionnaire star platform, and 650 valid questionnaires were finally retained, with an effective rate of 85.52%. Among them, 203 males and 447 females; 377 undergraduate students from Double First-Class Universities; The number of students majoring in natural sciences is 319, business is 109, and the other 222; There were 364 rural residents and 286 non rural residents. The structural characteristics of the sample described above were similar to the total, indicating that the sample has a certain degree of representativeness.

Measurements

All variables were measured by well-established scales that initially developed in English. We carried out a back-translation procedure to ensure that the meaning expressed in the Chinese version was consistent with the English version.

New venture ideas (NVIs). It was measured by Farmer et al.'s scale. Farmer et al. (2011) claimed that opportunity discovery processes refer to the initial conception and further development of a venture idea [71], which is just the new venture ideas according to Davisson's definition [1]. In the meta-analysis by Canavati and colleagues [65], the discovery scale was identified to assess new venture ideas. In this study, respondents were asked to check whether they have engaged in each of the particular behaviors in the past six months. Their responses were scored 0 (No) or 1 (Yes), and responses were summed to form the index. The indicators were formative, such as "I have engaged in a deliberate, systematic search for an idea for a new business". The scale was tested in the United States, China mainland and Taiwan, which showed good applicability. For evaluating its validity, we also used a global item with 5-point Likert scale (1 = never; 2 = less; 3 = sometimes; 4 = often; and 5 = always) to reflect new venture ideas. The item is "How often do you have new venture ideas during the past six months".

Entrepreneurial curiosity. This study adopted the epistemic curiosity scale developed by Litman and Spielberger (2003) [72]. The instrument had 10 items, five for the I-type entrepreneurial curiosity and five for the D-type entrepreneurial curiosity. The rating scale for all items ranged from 1"strongly disagree" to 5 "strongly agree", and the higher the score, the stronger the entrepreneurial curiosity of undergraduates. The items reflected respondents' psychological experience about entrepreneurship. One I-type curiosity sample item was "Enjoy exploring new ideas" and one D-type curiosity

sample item was "Interested in discovering how things work".

Promotion focus. We used the regulatory focus scale developed by Higgins et al. (2001) [73], in which there were 6 items for promotion focus on a Likert-type scale from 1 to 5 (1 = never; 2 = less; 3 = sometimes; 4 = often; and 5 = always). Among them, three questions were reverse scoring. After reverse-coded these responses, the higher the score, the more promotion focus inclined of the individual. A sample item was "How often have you accomplished things that got you 'psyched' to work even harder".

Entrepreneurial education. It was measured by 6 questions adopted from Franke and Lüthje (2004) [74]. This scale aimed to evaluate entrepreneurial education and its support through collecting respondents' perception of the entrepreneurial environment in universities, including the universities' innovation atmosphere, entrepreneurial education courses, and entrepreneurial support. The rating scale for all items ranged from 1"strongly disagree" to 5 "strongly agree". The higher the score, the better the students' evaluation of entrepreneurial education and its support, which meaned that students were more satisfied with entrepreneurial education in their universities. For instance, a sample item was "The courses foster the social and leadership skills needed by entrepreneurs".

Data analyses

We adopted a structural equation modelling (SEM) approach with partial least square (PLS) to test the measurement model and structural model with statistical package SmartPLS4. PLS-SEM was considered appropriate for our study for two reasons. First, PLS-SEM supports reflective and formative indicators, both of which were contained in the model of this study. Second, PLS-SEM is suitable for prediction and theoretical extension [75]. The proposed model was tested in two steps. The reliability and validity of the measurement model were initially tested by calculating the indicators recommended by Hair et al. (2017) [75]. Afterwards, the structural model was estimated using the bootstrapping method with 5000 resamples.

Results

Common method bias

Given all measures from respondents' self-report, we adopted ex ante and ex post procedures to reduce common method bias [76]. First, simple language, clear instructions, anonymity, and voluntary participation were ensured in the process of questionnaire design and distribution. Second, the Harman's single-factor test was performed. A total of 5 common factors with eigenvalues greater than 1 were obtained. The first common factor explained a total variance of 35.30% which was under the threshold of 50%. Therefore, common method bias was not a serious issue in this study.

Assessment of measurement model

Since indicators used to assess new venture ideas were formative, the analysis of the measurement model involved examining the convergent validity, indicator weights and loadings, and indicator multicollinearity [75, 77]. A redundancy analysis was performed to establish the convergent validity. We built a new model by SmartPLS 4 which used the formative latent variable for new venture ideas to predict the reflective latent variable for that operationalized through the global item. The path coefficient between two latent variables was 0.875, which exceeded the recommended value of 0.8 [75]. Table 1 shows size and significance of indicator weights and loadings by adopting the bootstrapping procedure. Regarding indicator weights, all weights are statistically significant except NVIs_5, NVIs_7, and NVIs_9. We further checked the significance of these three indicator loadings. T-Values for these loadings are bigger than 1.96 [78]. Therefore, the results of indicator weights and loadings demonstrated indicator relevance. Moreover, the VIF values in Table 1 are all smaller than 3, which indicates multicollinearity is not a problem [79].

Indicator loadings, internal consistency reliability, as well as the convergent and discriminant validity were employed to evaluate the reflective constructs through

Table 1 Goodness of formative measurement model of new venture ideas

Indicators	Outer weights	T-Statistics$_{weights}$	Outer loadings	T-Statistics$_{loadings}$	VIF
NVIs_1	0.344	6.162	0.737	19.668	1.423
NVIs_2	0.414	6.898	0.798	23.900	1.587
NVIs_3	0.202	3.292	0593	11.633	1.358
NVIs_4	0.148	2.659	0.465	8.255	1.262
NVIs_5	-0.014	0.274	0.387	6.845	1.299
NVIs_6	0.221	4.474	0.351	6.379	1.031
NVIs_7	0.052	0.855	0.413	6.731	1.235
NVIs_8	0.252	4.767	0.497	9.229	1.207
NVIs_9	0.023	0.344	0.389	5.819	1.241

Table 2 Reliability and convergent validity for reflective measurement models

Constructs	Indicators	Outer loadings	*T*-Statistics	Cronbach Alpha (α)	CR (ρ_a)	AVE
1. I-type Entrepreneurial Curiosity (ECI)	ECI_1	0.804	43.373	0.911	0.924	0.743
	ECI_2	0.916	102.423			
	ECI_3	0.929	129.007			
	ECI_4	0.919	116.916			
	ECI_5	0.724	29.255			
2. D-type Entrepreneurial Curiosity (ECD)	ECD_1	0.745	33.755	0.897	0.906	0.711
	ECD_2	0.822	50.153			
	ECD_3	0.895	93.324			
	ECD_4	0.901	94.894			
	ECD_5	0.844	63.020			
3. Promotion Focus (PF)	PF_1	0.612	17.619	0.795	0.817	0.501
	PF_2	0.773	46.059			
	PF_3	0.736	33.727			
	PF_4	0.623	17.281			
	PF_5	0.763	38.324			
	PF_6	0.677	23.278			
4. Entrepreneurial Education (EE)	EE_1	0.791	42.573	0.909	0.910	0.687
	EE_2	0.840	56.298			
	EE_3	0.844	57.974			
	EE_4	0.769	39.143			
	EE_5	0.856	64.686			
	EE_6	0.869	72.458			

Note: CR and AVE are the abbreviations of composite reliability and average variance extracted, respectively

Table 3 Discriminant validity for reflective measurement models

Constructs	1	2	3	4	Heterotrait-Monotrait Ratio		
					1	2	3
1. I-type Entrepreneurial Curiosity	**0.862**						
2. D-type Entrepreneurial Curiosity	0.731***	**0.843**			0.808		
3. Promotion Focus	0.490***	0.508***	**0.708**		0.576	0.600	
4. Entrepreneurial Education	0.536***	0.560***	0.521***	**0.829**	0.591	0.620	0.612

Note: The diagonal values in bold are square roots of AVE. *** $p < 0.001$

the PLS-SEM algorithm (Hair et al., 2019) [77]. As depicted in Table 2, the values of outer loadings are all above 0.708 for I-type entrepreneurial curiosity, D-type entrepreneurial curiosity, and entrepreneurial education, which meets the criteria proposed by Hair and colleagues (2017) [75]. In terms of promotion focus, three of indicators loadings (PF_1, PF_4, PF_6) are below 0.708. However, their T-values show statistical significance. And following Hair and colleagues (2017) advice [75], deletion of these three indicators didn't lead to increase in AVE and composite reliability. Meanwhile, the loadings satisfied the requirement of being greater than 0.6 recommended by Chin (1998)[1] [80]. Thus the indicators were retained. The internal consistency reliability of the construct was measured by Cronbach alpha and composite reliability. Table 2 displays that the Cronbach's α is 0.795 ~ 0.911 for I-type entrepreneurial curiosity, D-type entrepreneurial curiosity, promotion focus, and entrepreneurial education, respectively. And their composite reliability is 0.817 ~ 0.924 correspondingly. Both reliabilities are all above the rule of thumb, 0.70 [77]. The convergent validity was analyzed by examining the average variance extracted (AVE). The AVE for each construct in Table 2 exceeds the threshold value of 0.50 [75].

Finally, we used Fornell-Larcker Criterion and Heterotrait-Monotrait Ratio to analyze the discriminant validity. According to Fornell-Larcker Criterion, the square root of the AVE for each construct in Table 3 is greater than the correlation coefficient between the constructs. The results indicate good discriminant validity between each latent variable. Table 3 also shows that the Heterotrait-Monotrait Ratio is below 0.90 accepted as admissible [77].

Structural model test

Using SmartPLS 4 to establish a structural equation model, the significance test included a *p*-value at the

[1] We also remove these three indicators and reanalyze the data. The results are similar to that reported here.

Table 4 Structural model results

Constructs	R^2	Adj. R^2	Q^2	VIF	SRMR	$Q^2_{predict}$
I-type Entrepreneurial Curiosity	-	-	-	{2.154,2.335}	-	-
D-type Entrepreneurial Curiosity	-	-	-	{2.154,2.422}	-	-
Promotion Focus	0.320	0.318	0.248	1.634	-	0.313
Entrepreneurial Education	-	-	-	1.716	-	-
New Venture Ideas	0.433	0.428	0.219	-	0.058	0.386
Entrepreneurial Education * Promotion Focus	-	-	-	1.007	-	-

Table 5 Hypotheses testing (direct and indirect effects)

Structural path	Direct/ Indirect effects	M	SD	95% CI		T-Statistics	*P* values
				LLCI	ULCI		
I-type Entrepreneurial Curiosity → New Venture Ideas	0.249	0.251	0.043	0.165	0.337	5.740	***
D-type Entrepreneurial Curiosity → New Venture Ideas	0.036	0.036	0.048	-0.061	0.126	0.749	0.454
Promotion Focus → New Venture Ideas	0.148	0.149	0.037	0.074	0.219	3.986	***
I-type Entrepreneurial Curiosity → Promotion Focus	0.280	0.281	0.050	0.180	0.377	5.638	***
D-type Entrepreneurial Curiosity → Promotion Focus	0.327	0.328	0.051	0.226	0.424	6.374	***
I-type Entrepreneurial Curiosity → Promotion Focus → New Venture Ideas	0.041	0.042	0.013	0.020	0.071	3.197	0.001
D-type Entrepreneurial Curiosity → Promotion Focus → New Venture Ideas	0.048	0.049	0.015	0.023	0.080	3.280	0.001
Entrepreneurial Education → New Venture Ideas	0.307	0.311	0.040	0.221	0.380	7.611	***
Entrepreneurial Education *Promotion Focus → New Venture Ideas	0.163	0.167	0.021	0.118	0.201	7.652	***

Note: *** $p < 0.001$

0.05 level and a 95% Bootstrap confidence interval based on bias correction, with 5000 self-sampling attempts. The model fitting indicators provided in Table 4 show that the R^2 of endogenous variables is greater than 0.3; Blindfolding-based Q^2 is larger than 0; The VIFs of both independent and intermediate variables are less than 3; SRMR = 0.058 (< 0.08), indicating that the data fits the model well. Additionally, the results from $PLS_{predict}$ procedure show that $Q^2_{predict}$ is 0.313 for promotion focus, and 0.386 for new venture ideas respectively (larger than 0) and the majority of these two constructs indicators (8 to 15) have lower RMSE than the LM benchmark, which means our model has moderate predictive capabilities [81]. Therefore, hypothesis testing can be performed on structural equation model.

Hypotheses test

We tested the proposed hypotheses with SmartPLS 4 by Bootstrapping 5000 resamples. As presented in Table 5, the direct effect results show that I-type entrepreneurial curiosity has a significant positive effect on new venture ideas (β = 0.249, P<0.001) and promotion focus (β = 0.280, P<0.001). D-type entrepreneurial curiosity only has a significant positive effect on promotion focus (β = 0.327,P<0.001), whilst its positive effect on new venture ideas is insignificant (β = 0.036, P > 0.05). Thus, H1 receives partial support. Obviously, the effect of I-type entrepreneurial curiosity on new venture ideas is stronger than D-type entrepreneurial curiosity. Meanwhile, promotion focus has a significant positive effect on new venture ideas (β = 0.148, P<0.001).

As for the mediating effects of promotion focus, the results indicate that the indirect effect of I-type entrepreneurial curiosity on new venture ideas through promotion focus is 0.041 (P = 0.001). The indirect effect of D-type entrepreneurial curiosity on new venture ideas through promotion focus is 0.048 (P = 0.001). Thus, H2 is confirmed. According to the mediation analysis procedure recommended by Hair and colleagues(2017) [75], promotion focus plays a partial mediating effect between I-type entrepreneurial curiosity and on new venture ideas. Promotion focus may serve as full mediation of the relationship between D-type entrepreneurial curiosity and on new venture ideas.

Finally, the moderating effects of entrepreneurial education were examined. Table 5 reveals that the path coefficient from the interaction between entrepreneurial education and promotion focus to new venture ideas is 0.163 (P<0.001), which indicates that entrepreneurial education positively moderates the relationship between promotion focus and new venture ideas. This study carried out a permutation multigroup analysis (MGA). Two groups were first generated according to the median of entrepreneurial education. 355 samples being above and equal to the median were categorized into high-level entrepreneurial education group. The remaining 295 samples were defined as low-level entrepreneurial education group. Prior to conducting the MGA, measurement invariance needs to be ensured. Table 6 presents the results of measurement invariance test using MICOM procedure, which shows that both configural and compositional invariance are achieved, but the equal means

Table 6 Results of invariance measurement testing using MICOM procedure

Constructs		I-type Entrepreneurial Curiosity	D-type Entrepreneurial Curiosity	Promotion Focus	New Venture Ideas
Configurational Invariance (Step1)		Yes	Yes	Yes	Yes
Compositional Invariance (Step2)	Original correlation	0.999	1.000	0.994	0.945
	5%	0.999	0.999	0.986	0.872
	Permutation *p*-value	0.105	0.936	0.447	0.591
Equal Mean (Step 3a)	Original difference	0.107	0.148	0.152	0.160
	95% CI	[-0.150,0.150]	[-0.145,0.152]	[-0.141,0.147]	[-0.153,0.167]
	Permutation *p*-value	0.181	0.068	0.037	0.078
Equal Variance (Step 3b)	Original difference	0.223	0.162	-0.020	0.238
	95% CI	[-0.216,0.219]	[-0.222,0.229]	[-0.260,0.250]	[-0.222,0.222]
	Permutation *p*-value	0.044	0.144	0.890	0.013

Note: CI is the abbreviation of confidence interval

Table 7 Results of permutation multi-group analysis for entrepreneurial education

Structural path	Path coefficient/Indirect effects		Difference	95% CI		Permutation *p*-value
	High-level Entrepreneurial Education (*n* = 355)	Low-level Entrepreneurial Education (*n* = 295)		LLCI	ULCI	
I-type Entrepreneurial Curiosity → New Venture Ideas	0.291	0.243	0.047	-0.180	0.174	0.624
D-type Entrepreneurial Curiosity → New Venture Ideas	0.152	0.032	0.120	-0.218	0.192	0.228
I-type Entrepreneurial Curiosity → Promotion Focus	0.268	0.193	0.074	-0.171	0.203	0.456
D-type Entrepreneurial Curiosity → Promotion Focus	0.265	0.283	-0.017	-0.220	0.186	0.866
Promotion Focus → New Venture Ideas	0.271	0.054	0.217	-0.159	0.153	***
I-type Entrepreneurial Curiosity → Promotion Focus → New Venture Ideas	0.073	0.010	0.063	-0.052	0.052	***
D-type Entrepreneurial Curiosity → Promotion Focus → New Venture Ideas	0.072	0.015	0.058	-0.061	0.055	0.045

Note: *** $p < 0.001$

and variances between two groups are not established. So partial measurement invariance is confirmed.

Results of permutation multi-group analysis shown in Table 7 shows that there is significant difference for the path coefficient from promotion focus to new venture ideas between high-level entrepreneurial education group (β = 0.271) and low-level entrepreneurial education group (β = 0.054). Additionally, the indirect effect from entrepreneurial curiosity (I-type entrepreneurial curiosity and D-type entrepreneurial curiosity) to new venture ideas through promotion focus also differs significantly across two conditions of entrepreneurial education. Specially, the indirect effect of I-type entrepreneurial curiosity on new venture ideas through promotion focus is 0.073 in high-level entrepreneurial education group whereas it is 0.010 in low-level entrepreneurial education group. The indirect effect of D-type entrepreneurial curiosity on new venture ideas through promotion focus is 0.072 in high-level entrepreneurial education group whereas it is 0.015 in low-level entrepreneurial education group. Hence, it suggests that entrepreneurial education plays a significant moderating role in the indirect effect of entrepreneurial curiosity on new venture ideas through promotion focus, which supports H3. We also reran a bootstrap multi-group analysis. The results unreported here for space limits were statistically similar. Consequently, the moderating effects of entrepreneurial education are confirmed.

Discussion

Firstly, the results indicated that I-type entrepreneurial curiosity has a positive predictive effect on undergraduates' new venture ideas, while D-type entrepreneurial curiosity has not, which partially support our hypothesis. These conclusions seem inconsistent with earlier findings. Previous research, in which curiosity was viewed as a whole, has confirmed the positive effects of undergraduates' curiosity on creativity [15, 56, 82]. While other studies widely treated curiosity as a psychological state closely related to interest [21, 25], such a view encompasses only the I-type curiosity. The impact of I-type curiosity on new venture ideas can be explained by the broaden-and-build theory of positive emotions, which also provides a certain theoretical foundation for the conclusion that D-type entrepreneurial curiosity, accompanied by a negative feeling, cannot directly affect

new venture ideas. Moreover, for individuals with D-type entrepreneurial curiosity, the main purpose of their exploration is to eliminate cognitive dissonance. When the information gap is filled, D-type curiosity will no longer exist, which means that D-type curiosity cannot further produce its effect. D-type curiosity was unrelated to both creative problem solving and creative performance [16]. But In the subsequent exploration process, the energy invested, information obtained, and knowledge accumulated by individuals contribute to the formation of creative ideas [5, 33, 34]. In a nutshell, D-type entrepreneurial curiosity can stimulate proactive exploration, and proactive exploration rather than D-type entrepreneurial curiosity is the real factor affecting new venture ideas among undergraduates.

Secondly, the mediating role of promotion focus between entrepreneurial curiosity and new venture ideas is confirmed. It is worth noting that, there are differences in mechanisms on promotion focus for two types of entrepreneurial curiosity, which can be explained by the broaden-and-build theory of positive emotions and the information-gap theory of curiosity, respectively. The positive emotions associated with I-type curiosity can strengthen an individual's intrinsic motivation [52], demonstrating a higher willingness to explore new things [59]. Promotion focus tendency triggered by D-type curiosity, which originates from the information gap, will inevitably push individuals to explore in order to fill the information gap [8, 9]. I-type entrepreneurial curiosity triggers proactive entrepreneurship-search, while D-type entrepreneurial curiosity even with a trace of helplessness, which can be seen as an individual's passive behavior that is unavoidable under uncertainty.

Finally, the moderating role of entrepreneurial education in the indirect effect of entrepreneurial curiosity on new venture ideas through promotion focus is confirmed too. Results show that entrepreneurial education can further enhance the goal-oriented behavior of undergraduates, making their entrepreneurial exploration more active. Additionally, the entrepreneurial knowledge and skills acquired in entrepreneurial courses can further help individuals understand innovation, then focus on innovation, and even promote innovation [64]. Moreover, Piperopoulos and Dimov (2015) argued that, practice-oriented courses provide the "can" of entrepreneurial actions and thus demonstrate how possibilities emerge from a given set of entrepreneurial inputs (e.g., skills, resources, or knowledge) [83]. Students in such a setting tend to view their own entrepreneurial behavior as a starting point, to be developed further. The results regarding the moderating effect of entrepreneurial education are consistent with the reform of entrepreneurial education in China, which emphasizes practice-oriented.

Theoretical implications

This study takes new venture ideas as the outcome variable of undergraduates' entrepreneurship activities, which attracts scholars' attention to new venture ideas. Previous studies have mainly focused on entrepreneurs in the business field and used entrepreneurial opportunity, opportunity identification and entrepreneurial discovery as the outcome variables, because these variables directly point to entrepreneurial behavior itself. Compared to encouraging undergraduates to start their own businesses, developing their entrepreneurial spirit and entrepreneurial awareness is more important. This study mainly concentrates on undergraduates, who is the most innovative group in society. And new venture ideas, a variable that reflects undergraduates' bold imagination and free exploration, is chosen as the outcome variable, which aligns with the Chinese government's advocacy of enhancing undergraduates' entrepreneurial spirit and awareness.

In addition, this study enriches the research on the formation mechanism of new venture ideas. Firstly, this study explored the direct effects of two types of entrepreneurial curiosity on new venture ideas, which has not been well studied previously. Entrepreneurial curiosity provides a new perspective for understanding the formation of new venture ideas and helps elucidate the psychological mechanisms underlying entrepreneurial behavior. According to the classification of epistemic curiosity by Litman and Jimerson (2004) [6], this study also divides entrepreneurial curiosity into I-Type and D-Type, which further refines the research on the impact of entrepreneurial curiosity on new venture ideas. Secondly, this study takes promotion focus as a mediator to explore how two types of entrepreneurial curiosity affect new venture ideas. That's to say, promotion focus is considered as individual state rather than individual trait in this study. Thirdly, entrepreneurial education, unlike being used as an antecedent variable for entrepreneurial activities in previous studies, the moderating role is explored in this study.

Furthermore, this study has not only integrated but also extended theoretical frameworks. By integrating the broaden-and-build theory of positive emotions, the information-gap theory of curiosity, the regulatory focus theory, and the regulatory fit theory, we propose an analytical framework to investigate how undergraduates generate new venture ideas. It provides a new theoretical perspective for understanding the essence and formation process of new venture ideas. At the same time, this study also challenges the limitations of existing theories in explaining the formation of new venture ideas, and establishes a novel theoretical model based on entrepreneurial cognition.

Practical implications

Universities should aim to stimulate undergraduates' entrepreneurial interest while cultivating their I-type entrepreneurial curiosity. As the results showed, I-type entrepreneurial curiosity can not only directly promote the formation of new venture ideas among undergraduates, but also indirectly influence it by promotion focus. Therefore, according to the broaden-and-build theory of positive emotions [7], by stimulating undergraduates' interest in entrepreneurship and increasing their positive emotional experiences in entrepreneurial education, they may directly creat new venture ideas, or develop promotion focus tendency to indirectly generate new venture ideas. For example, universities can provide entrepreneurial courses with interest, diversity, and exploration for undergraduates. When students are attracted to the course and develop an interest in entrepreneurship, this positive emotion can continue to drive entrepreneurship search, thus promoting the formation of new venture ideas. Besides, entrepreneurial practice is also an important means that leads students to promotion focus tendency [83]. Hence, universities should encourage undergraduates to actively participate in various entrepreneurial practices, such as entrepreneurial competitions, entrepreneurial lectures, practical internships, entrepreneurial training, etc., through which they may experience the joy of entrepreneurship-search.

Heuristic teaching should be used to develop undergraduates' D-type entrepreneurial curiosity in universities. As mentioned above, D-type entrepreneurial curiosity cannot directly affect new venture ideas, but can positively affect it through promotion focus. Therefore, it is necessary to emphasize the role of D-type entrepreneurial curiosity in stimulating undergraduates' promotion focus tendency. Teachers can adopt situational teaching method, in the form of team learning, enabling students to identify problems and become aware of their own knowledge deficiencies. Moreover, team learning also helps students recognize personal competency gaps through team interaction and sharing, thereby producing D-type curiosity based on information gaps. Although D-type curiosity is accompanied by feelings of uncertainty and tension, which seem to be terrible for individuals. Indeed, compared to I-type curiosity, its reactions reflect a more powerful motive for learning [9]. Therefore, it's crucial to harness strong motivation for learning triggered by D-type curiosity, which encourage undergraduates to continuously explore.

Limitations and future directions

The present study has several limitations that could indicate avenues for future research. First, our study employed a cross-sectional survey design. It enabled us to collect a large amount of sample data within a relatively short period of time. But it may yield common method bias and limit the validity in establishing the order of effects among focal variables. Second, promotion focus acted as the only mediator between entrepreneurial curiosity and new venture ideas in current research. Although we believe that promotion focus plays an important role through theoretical analysis and literature review, it may be more complex. There may be multiple mediating variables working together, or there may be other mediating mechanisms that have not yet been discovered. Third, we employed the questionnaire relied on self-report to collect data. It was easy to operate and relatively low-cost, and it can obtain the subjective feelings and evaluations of the participants. However, it may also incur common method bias even though we tried to control it. Despite the aforementioned limitations, this study still has certain innovativeness and value. By employing a cross-sectional design, we collected a large amount of sample data which lays the foundation for subsequent longitudinal studies. Moreover, our choice of regulatory focus as a mediator is significant both theoretically and practically, and the research findings offer a new perspective for studies in related fields. Additionally, the data collected through the self-report method can reflect the subjective experiences of participants, which is irreplaceable for understanding individuals' psychology and behavior.

In response to the limitations of this study, we propose the following directions for future research: First, longitudinal or experimental designs can be considered in the future when there is sufficient research time and adequate experimental resources, in order to examine the validity of the model presented here. Second, we need to explore the role of prevention focus, another form of self-regulatory focus, or other variables, in entrepreneurship. Especially, what changes will happen to this mechanism when self-regulatory focus is taken as personal trait rather than situational motivation? This also merits further research. Third, Qualitative analysis or in-depth interviews may be utilized by scholars to ensure the accuracy of the causal pathways among variables. We can stimulate undergraduates' entrepreneurial curiosity through task scenarios, then conduct curiosity type tests and focus tendency surveys, and further evaluate their quantity and quality of new venture ideas through task solving. Furthermore, it is possible to divide undergraduates into an experimental group and a control group based on whether they have received entrepreneurial education, to analyze the difference in entrepreneurial curiosity and its impact on new venture ideas between the two groups.

Conclusion

This study explored the direct effects of two types of entrepreneurial curiosity on new venture ideas, and proved the mediating role of promotion focus between them. Moreover, this study innovatively took entrepreneurial education as a moderator, and confirmed its moderating role in the relationships discussed above. In general, compared to traditional research that focused on undergraduates' entrepreneurial opportunity, this study chose new venture ideas for research, which aligns with the policy objectives of innovation and entrepreneurship education in China. The conclusions drawn from this study not only refine the research on entrepreneurial curiosity but also enrich the study of the formation mechanism of new venture ideas, providing insights for future reforms in entrepreneurial education.

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Author contributions
C.L. conducted theoretical framework design, data collection, and paper writing. R.H. provided guidance on the theoretical framework and suggested revisions to the manuscript.

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Data availability
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
All procedures in this study were approved by the authors' institutional research ethics committee (School of Public Administration, Huazhong Agricultural University). Informed consent was also obtained in the study. We confirm that all methods were carried out in accordance with relevant guidelines and regulations.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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