

Full Length Research Paper

Effect of college students' perceived authentic leadership on innovation behavior: The serial mediation effects of trust climate and creative self-efficacy

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This study investigated the relationship between the perceived authentic leadership of college students and their innovation behavior according to social cognitive theory and further explored the mediating effect of trust climate and creative self-efficacy on this relationship. A questionnaire survey was conducted, and more than 847 samples were collected from college students in China. The results revealed that the perceived authentic leadership of college students had a significant and positive impact on their innovation behavior. Trust climate had a partial mediating effect on the relationship between college students' perceived authentic leadership and innovation behavior. In addition, creative self-efficacy had a partial mediating effect on the relationship between college students' perceived authentic leadership and innovation behavior. Furthermore, trust climate and creative self-efficacy had a serial mediating effect on the relationship between college students' perceived authentic leadership and innovation behavior. These results provide theoretical and practical evidence of college students' innovation behavior.

Key words: Authentic leadership, trust climate, creative self-efficacy, innovation behavior, college students.

INTRODUCTION

Innovation behavior is a crucial skill that enterprises require from college graduates (Zhao et al., 2022), and it refers to the actions and activities that individuals undertake to propose and promote new perspectives and concepts that can lead to novel solutions to problems (Selznick et al., 2022). Innovation behavior not only influences individual activities but also contributes to economic growth and competitiveness among nations (Bock et al., 2020; Chen et al., 2022). Shi et al. (2023)

claimed that innovation behavior is the fundamental skill that contemporary college students should possess. Cultivation of innovation behavior in college students has become the core goal of higher education in many countries globally. Extensive studies on innovation behavior have been conducted; in particular, those on college students' innovation behavior have attracted considerable attention in the higher education field (Alt et al., 2023; Dai et al., 2022; Kim and Koh, 2018).

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Authentic leadership as an active leadership method has been found to be a crucial predictive factor of employees' innovation behavior (Claudia et al., 2012; Gardner et al., 2011; Shang et al., 2019). Educational research has indicated that teachers' authentic leadership is a key predictive factor of college students' innovation behavior (Greenier and Whitehead, 2016) and refers to a method in which teachers use authentic, transparent, and ethical behavior to lead students (Kleynhans et al., 2021). Teachers' authentic leadership can promote students' innovation behavior through incentive and authorization methods by expanding students' thinking and encouraging them to implement their ideas (Schuckert et al., 2018; Srivastava and Dhar, 2019).

Studies have reported that trust climate and creative self-efficacy help students to actively respond to challenges during the learning process and enhance their confidence in achieving the goal; thus, these two factors are crucial to students' innovation behavior (Chen et al., 2022; Kistyanto et al., 2022). Studies have indicated that teachers' authentic leadership significantly and positively influenced the trust climate and creative self-efficacy of students (Butler-Henderson and Crawford, 2020; Lee et al., 2022). In addition, Clegg et al. (2002) verified that a favorable trust climate enhances teacher–student exchanges and collaborations, thereby boosting students' creative self-efficacy. The present study explored the serial mediating role of two key factors, namely trust climate and self-efficacy, in the relationship between college students' perceived authentic leadership and innovation behavior.

Based on social cognitive theory and the interaction among individuals, the environment, and behavior (Bandura, 1986), the present study considered college students' perceived authentic leadership and trust climate as environmental factors, creative self-efficacy as an individual factor, and innovation behavior as a behavioral factor and explored the relationship among the four variables. Specifically, the present study explored the effect of college students' perceived authentic leadership on their innovation behavior and the single and serial mediation effects of trust climate and creative self-efficacy on the effect of college students' perceived authentic leadership on their innovation behavior.

LITERATURE REVIEW AND RESEARCH HYPOTHESES

College students' perceived authentic leadership and innovation behavior

Authentic leadership refers to a leadership behavior that is inspired by positive psychological capacities and a positive ethical climate (Walumbwa et al., 2008). Walumbwa et al. (2008) reported that authentic leadership comprises four dimensions, namely self-awareness,

relational transparency, internalized moral perspective, and balanced processing.

Self-awareness refers to how clearly a leader knows how to influence others. Relational transparency refers to the demonstration of the true self of the leader without disguise. Internalized moral perspective refers to the consistency of the leader's behavior to their values. Balanced processing refers to the ability of the leader to listen to different opinions and objectively analyze various types of information (Walumbwa et al., 2010). In addition, Rego et al. (2012) indicated that authentic leaders can efficiently establish authentic relationships with employees by enhancing the employees' acceptance of the leaders' core values and moral sense, which, in turn, boosts the performance and innovation levels of the employees. Extensive studies on the relationship between authentic leadership and innovation behavior in the organization and management fields have been conducted. Bamford et al. (2013) indicated that authentic leadership is a key factor that promotes individual innovation behavior. Specifically, the self-awareness and self-regulation of an authentic leader influence employees' attitude and behavior, thereby affecting employees' innovation behavior (Gardner et al., 2011). Empirical studies have reported that authentic leadership significantly and positively influenced employee innovation behavior (Claudia et al., 2012; Shang et al., 2019; Yamak and Eyupoglu, 2021).

Butler-Henderson and Crawford (2020) reported that authentic leadership plays a crucial role in educational systems. The application of the authentic leadership model in educational systems enables teachers to guide students' growth and development through active behavior. Kleynhans et al. (2021) defined teachers' authentic leadership as a method by which teachers can use authentic, transparent, and moral behavior to lead students. Teachers' authentic leadership can help model high moral standards in students and encourage them to express innovative ideas more efficiently, which can lead to improved behavioral performance among students (Alruz et al., 2020; Peus et al., 2012). Previous empirical studies have explored the relationship between teachers' authentic leadership and innovation behavior. For example, Greenier and Whitehead (2016) identified that teachers' authentic leadership can enhance students' active participation and innovation behavior through teachers' consistent expression of self-values and authentic self. In addition, authentic leadership enables teachers to seek suggestions from students and encourage students to propose their creative ideas, thereby enhancing students' innovation behavior (Schuckert et al., 2018; Srivastava and Dhar, 2019). Thus, the present study proposed Hypothesis 1 (H1) as follows:

H1: College students' perceived authentic leadership significantly and positively affects innovation behavior.

College students' perceived authentic leadership, trust climate, and innovation behavior

Trust climate is a unique organizational climate (Costigan et al., 1998) that reflects an individual's comprehensive assessment of trust in the internal environment of their affiliated organization (Patterson et al., 2004). Berraies et al. (2014) indicated that trust climate is a crucial factor that affects innovation behavior. A favorable climate trust can effectively increase employees' cooperation levels and work enthusiasm, thereby promoting innovation behavior among the employees (Hoang et al., 2022; Mou et al., 2021). In the educational context, climate trust provides conditions conducive to innovation and is critical to student innovation (Kistyanto et al., 2022). Trust climate can also encourage students to actively seek feedback, learn skills and acquire knowledge, seek efficient learning methods, and increase their innovation behavior (Greenier and Whitehead, 2016). Moreover, students are encouraged to exchange their ideas and share knowledge with other students and motivate each other, which contribute to innovation behavior (Algera and Lips-Wiersma, 2012). Leighton et al. (2016) identified that a favorable trust climate can increase college students' innovation behavior.

Empirical studies have demonstrated that teachers' authentic leadership significantly and positively influenced Trust climate (Kulophas et al., 2015; Wiewiora and Kowalkiewicz, 2018; Wu and Xu, 2022). Authentic teachers express their authentic emotions, which increases the relational transparency between teachers and students, thereby enhancing trust climate (Park and Kim, 2021; Walumbwa et al., 2008). In addition, previous empirical studies on innovation behavior have often used trust climate as a mediating variable (Pachler et al., 2019; Wang, 2019). Therefore, college students' perceived authentic leadership positively affects trust climate, which increases college students' innovation behavior. Thus, the present study proposed Hypothesis 2 (H2) as follows:

H2: Trust climate has a mediating effect on the effect of college students' perceived authentic leadership on their innovation behavior.

College students' perceived authentic leadership, creative self-efficacy, and innovation behavior

Bandura (1977) first proposed the concept of self-efficacy and defined it as the level of confidence people have in themselves to complete a given work with the skills they possess. Creative self-efficacy is an extension of self-efficacy in the creativity domain and is defined as the confidence of a person in obtaining creative outcomes in innovation activities (Tierney and Farmer, 2002). Teng et al. (2020) stated that creative self-efficacy is the internal driving force of individual innovation and has a positive

effect on individuals' innovation behavior. Javed et al. (2021) verified that creative self-efficacy significantly and positively affected employee innovation behavior. A study indicated that students' creative self-efficacy is a crucial factor that affects their innovation behavior (Lemonsa, 2010). The implementation of innovation behavior involves numerous challenges. The confidence among students as a result of their creative self-efficacy enables them to believe that they are capable of facing the difficulties and challenges during the innovation process (Afsar and Masood, 2017). Moreover, students with high creative self-efficacy are adept in learning new skills and acquiring knowledge and thus more actively engage in innovation behavior (Hirst et al., 2015). An empirical study on college students indicated that their creative self-efficacy promoted their innovation behavior (Chen et al., 2022).

Teachers' authentic leadership is an antecedent variable that affects students' creative self-efficacy (Kulophas et al., 2015). Because it encourages students to make decisions independently and provides them more space to improve their skills and confidence in performing creative activities, thereby increasing their creative self-efficacy (Alruz et al., 2020; Purwanto et al., 2021). Empirical studies have indicated that teachers' authentic leadership significantly increased college students' creative self-efficacy (Rego et al., 2012; Srivastava and Dhar, 2019; Srivastava et al., 2022). Moreover, studies have indicated that creative self-efficacy has a mediating effect on the relationship between the teachers' leadership style and innovation behavior (Gu et al., 2017; Lei et al., 2021; Wang et al., 2022). The present study infers that college students' perceived authentic leadership has a positive effect on their creative self-efficacy, thereby promoting their innovation behavior. Thus, this study proposed Hypothesis 3 (H3) as follows:

H3: Creative self-efficacy has a mediating effect on the effect of college students' perceived authentic leadership on their innovation behavior.

College students' perceived authentic leadership, trust climate, creative self-efficacy, and innovation behavior

According to the literature review, although trust climate and creative self-efficacy have a single mediating effect on the relationship between teachers' authentic leadership and innovation behavior, whether they have a serial mediating effect requires further exploration. Authentic leadership enables teachers to demonstrate their authentic self to students through self-awareness and attitude and behavior toward students, establish trust relationships with students, and build a favorable trust climate (Kleynhans et al., 2021). A favorable trust climate

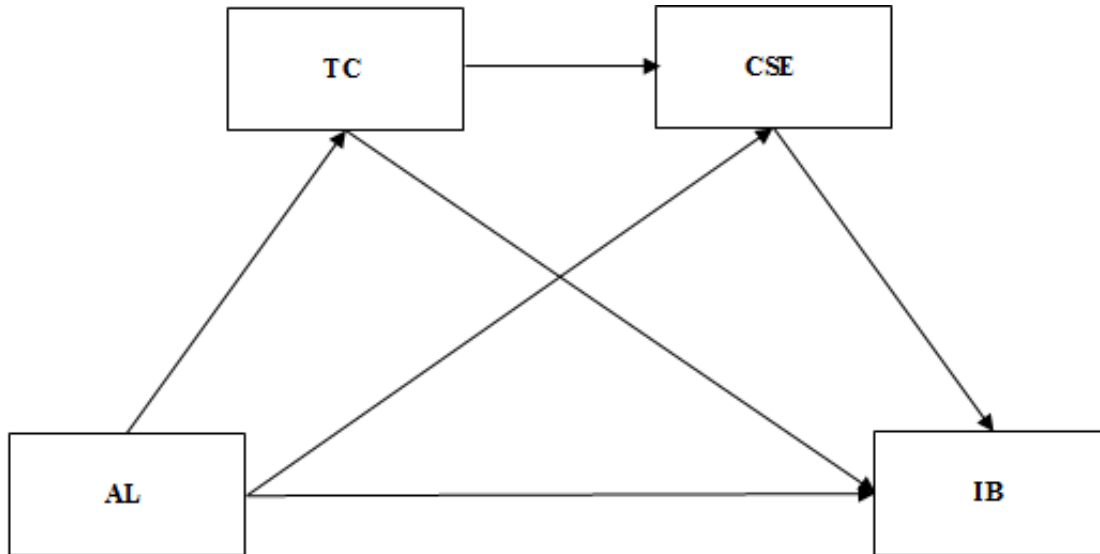


Figure 1. Author Research framework. AL=authentic leadership; TC=trust climate; CSE= creative self-efficacy; IB= Innovation behavior.

promotes intensive and extensive cooperation and exchange among students, helps them acquire inspiration and develop creativity in solving problems, and increases their creative self-efficacy (Greenier and Whitehead, 2016). In addition, a favorable trust climate enhances students' confidence and enables them to develop positive thinking and actively participate in creative activities, thereby strengthening the students' creative self-belief (Isaksen, 2010; Zhou and George, 2003). These findings suggest trust climate increases students' creative self-efficacy. Moreover, Lee et al. (2022) verified that trust climate is a key variable affecting creative self-efficacy. In summary, we infer that college students' perceived authentic leadership affects the trust climate, which increases their creative self-efficacy, and eventually promotes their innovation behavior. Thus, the present study proposed Hypothesis 4 (H4):

H4: Trust climate and creative self-efficacy have a serial mediating effect on the effect of college students' perceived authentic leadership on their innovation behavior.

In summary, although studies in the education field have reported that college students' perceived authentic leadership has a positive effect on their innovation behavior, the mechanism underlying this effect requires further exploration. Thus, the present study used social cognitive theory as the basis and trust climate and creative self-efficacy as the mediating variables to identify the mechanism underlying the effect of college students' perceived authentic leadership on their innovation behavior. The research framework is presented in Figure 1.

RESEARCH METHOD

Participants

With the aim of promoting the local economic and social development, the colleges of Hebei have integrated industry and education by facilitating the cooperation between schools and enterprises for inculcating innovation ability among students. Until now, a total of 42 universities in Hebei have been selected as national representative Colleges for deepening the innovation education reform (Sun et al., 2020). Therefore, college students in Hebei can serve as representative samples for exploring college students' innovative behavior and the influencing factors. In the present study, pilot test and formal test questionnaire survey were conducted. In the pilot test data, a total of 170 questionnaires were distributed, and after excluding invalid questionnaires, 154 questionnaires were obtained, with an effective recovery rate of 90.6%. The formal test data were determined using the purposive sampling and convenience sampling methods. Colleges in Hebei were divided into three levels: Vocational and technical colleges; General Colleges; and Double First-Class Colleges. First, purposive sampling was used to select two "national demonstration universities for deepening innovative education reform" from each of the three levels of universities. The performance of these six universities in innovative education of college students has been excellent, and students in these universities are often characterized by high innovative behavior. Second, using the convenience sampling method, a questionnaire survey of college students was conducted in these six representative universities. A total of 961 questionnaires were sent out, and after excluding invalid questionnaires, 847 questionnaires were obtained, with an effective recovery rate of 88.2%. Table 1 shows the demographic information of participants.

Measures

The study adopted an authentic leadership scale, a trust climate scale, a creative self-efficacy scale, and an innovation behavior scale for measurement. Since the measurement tools for this study

Table 1. Demographic information of the participants.

Demographic	Category	Frequency	%
Gender	Male	411	48.5
	Female	436	48.5
Grade	Freshman	221	26.1
	Sophomore	222	26.2
	Junior	215	25.4
	Senior	189	22.3

Source: Author

are the Authentic Leadership Scale, and the Trust Climate Scale, which were all developed by past researchers and written in English, they need to be translated into Chinese because the participants in this study are all Chinese college students. Generally, a proper translation procedure is required to secure implication equivalency between the source and target languages. Therefore, this study adopted the back-translation technique (Brislin, 1970). A bilingual scholar who speaks both English and Chinese and who is academically accustomed to the research topic translated the instrument into Chinese. Meanwhile, another bilingual scholar translated it back into English again. The original and back-translated versions were compared to identify differences and check for comparability. This study repeated this procedure until there was no meaning difference. The scales used are described in detail in the following:

Authentic leadership scale

The current study adopted the authentic leadership scale developed by Walumbwa et al. (2008) for assessing authentic leadership. The scale comprises of 16 items distributed across four dimensions, namely self-awareness, relational transparency, internalized moral perspective, and balanced processing. The scale was originally designed to measure the authentic leadership of enterprise employees. The present study modified the items in the original scale to be suitable for use in the educational context. Examples of the items are “My teacher knows clearly how his/her behavior affects others” (self-awareness), “My teacher encourages everyone to express their ideas” (relational transparency), “My teacher expresses faith consistent to behavior” (internalized moral perspective), and “My teacher seeks perspectives different from his/hers” (balanced processing). The items in the scale were scored on a 5-point Likert scale from 1 (*totally disagree*) to 5 (*totally agree*), with higher scores indicating a higher college students' perception of their teachers' authentic leadership. The pilot test data showed that the critical ratios of all items were greater than 3, and the correlation coefficient between each item and the total score were greater than 0.4. Cronbach's α did not increase after deleting items, which met the criteria for item retention. Hence, no item was deleted. The exploratory factor analysis showed that the factor loading of each item ranged from 0.512 to 0.773, with the cumulative explained variance in total being 79.800%. In formal test data, Cronbach's α for the four dimensions was 0.919, 0.933, 0.924, and 0.8850. Cronbach's α for the overall scale was 0.951. All Cronbach's α values were higher than 0.7, indicating favorable reliability (Nunnally, 1978).

The confirmatory factor analysis results were as follows: $\chi^2/df = 3.946$, RMSEA = 0.059, SRMR = 0.028, CFI = 0.976, NFI = 0.968, GFI = 0.946 and TLI = 0.970. The results suggested that the model fit was satisfactory (Hsiao et al., 2016).

Trust climate scale

The present study adopted a trust climate scale developed by McAllister (1995) for assessing trust among students. The scale comprises of 11 items distributed across two dimensions, namely affective trust and cognitive trust. The scale was originally designed for use in enterprise employees. The present study modified the items in the original scale to be suitable for use in the educational context. Examples of the items include “I can freely share my ideas, feelings, and hope with the teacher and classmates” (affective trust) and “The teacher's and classmates' behavior conform to my expectation” (cognitive trust). The items were scored on a 5-point Likert scale from 1 (*totally disagree*) to 5 (*totally agree*), with higher scores representing a more favorable trust climate. The pilot test data showed that the critical ratios of all items were greater than 3, and the correlation coefficient between each item and the total score were greater than 0.4. Cronbach's α did not increase after deleting items, which met the criteria for item retention. Hence, no item was deleted. The exploratory factor analysis showed that the factor loading of each item ranged from 0.569 to 0.852, with the cumulative explained variance in total being 63.349%. In formal test data, Cronbach's α for the two dimensions was 0.883 and 0.938. Cronbach's α for the overall scale was 0.931. All Cronbach's α values were higher than 0.7, indicating favorable reliability. The confirmatory factor analysis results were as follows: $\chi^2/df = 10.614$, RMSEA = 0.072, SRMR = 0.048, CFI = 0.943, NFI = 0.937, GFI = 0.902 and TLI = 0.927. The results suggested that the model fit was satisfactory.

Creative self-efficacy scale

This study adopted the creative self-efficacy scale developed by Yu (2018), which comprises 10 items distributed across two dimensions, namely problem solving ability and innovation ability. Examples of the items include “When I meet a difficult problem, I believe I can try a new way to solve it” (problem solving ability) and “Even if my colleagues do not encourage innovative ideas, I still think about problems and find different solutions” (innovation ability). The items in the scale were scored on a 5-point Likert scale from 1 (*totally disagree*) to 5 (*totally agree*), with higher scores indicating higher creative self-efficacy of the college student. The pilot test data showed that the critical ratios of all items were greater than 3, and the correlation coefficient between each item and the total score were greater than 0.4. Cronbach's α did not increase after deleting items, which met the criteria for item retention. Hence, no item was deleted. The exploratory factor analysis showed that the factor loading of each item ranged from 0.570 to 0.881, with the cumulative explained variance in total being 74.246%. In formal test data, Cronbach's α for the two dimensions was 0.922 and 0.936. Cronbach's α for the overall scale was 0.942. All Cronbach's α

Table 2. Correlation coefficients, means and standard deviations of variables.

Variable	AL1	AL2	AL3	AL4	TC1	TC2	CSE1	CSE2	IB1	IB2	IB3	IB4
AL1	1											
AL2	0.67***	1										
AL3	0.58***	0.70***	1									
AL4	0.60***	0.65***	0.66***	1								
TC1	0.48***	0.52***	0.47***	0.52***	1							
TC2	0.54***	0.58***	0.53***	0.53***	0.64***	1						
CSE1	0.46***	0.49***	0.44***	0.45***	0.52***	0.46***	1					
CSE2	0.46***	0.50***	0.45***	0.47***	0.49***	0.44***	0.67***	1				
IB1	0.50***	0.57***	0.50***	0.53***	0.53***	0.54***	0.50***	0.51***	1			
IB2	0.49***	0.53***	0.46***	0.49***	0.51***	0.46***	0.50***	0.59***	0.55***	1		
IB3	0.48***	0.52***	0.48***	0.50***	0.52***	0.50***	0.50***	0.59***	0.53***	0.65***	1	
IB4	0.47***	0.53***	0.50***	0.50***	0.52***	0.50***	0.49***	0.52***	0.59***	0.67***	0.69***	1
M	4.02	4.31	4.19	4.18	4.14	4.37	4.06	3.90	4.00	3.76	3.93	4.05
SD	4.31	0.75	0.81	0.79	0.76	0.70	0.77	0.78	0.88	0.89	0.80	0.78

AL=authentic leadership; TC=trust climate; CSE=creative self-efficacy; IB=innovation behavior; AL1= self-awareness; AL2=relational transparency; AL3=internalized moral perspective; AL4=balanced processing; TC1= affect-based trust; TC2=cognition-based trust; CSE1=problem solving ability; CSE2=innovation ability; IB1= modes of thinking; IB2=academic exploration; IB3=life practice; IB4=academic study; *** $p < 0.001$.

Source: Author.

values were higher than 0.7, indicating favorable reliability. The confirmatory factor analysis results were as follows: $\chi^2/df = 10.007$, RMSEA = 0.075, SRMR = 0.057, CFI = 0.951, NFI = 0.946, GFI = 0.915 and TLI = 0.938. The results suggested that the model fit was satisfactory.

Innovation behavior scale

This study adopted the innovation behavior scale developed by Li et al. (2019), which comprises 17 items across four dimensions, namely modes of thinking, academic exploration, life practice, and academic study. Examples of the items include "I can propose opinions different from traditional ideas and concepts" (modes of thinking), "I can engage in creative learning" (academic exploration), "I can discover problems that need to be solved in life" (life practice), and "I have strong curiosity about new knowledge" (academic study). The items in the scale were scored on a 5-point Likert scale from 1 (*totally disagree*) to 5 (*totally agree*), with higher scores indicating stronger innovation behavior of the college student. The pilot test data showed that the critical ratios of all items were greater than 3, and the correlation coefficient between each item and the total score were greater than 0.4. Cronbach's α did not increase after deleting items, which met the criteria for item retention. Hence, no item was deleted. The exploratory factor analysis showed that the factor loading of each item ranged from 0.531 to 0.834, with the cumulative explained variance in total being 73.569%. In formal test data, Cronbach's α for the four dimensions was 0.945, 0.895, 0.869, and 0.873. Cronbach's α for the overall scale was 0.947. All Cronbach's α values were higher than 0.7, indicating favorable reliability. The results of the confirmatory factor analysis were as follows: $\chi^2/df = 8.744$, RMSEA = 0.069, SRMR = 0.049, CFI = 0.927, NFI = 0.919, GFI = 0.902 and TLI = 0.912. The results suggested that the model fit was satisfactory.

Common method variance

This study adopted the Harman single factor testing method for

common method variance testing. A total of 12 factors with an eigenvalue >1 were obtained and the first factor variance explained was 35.995%, lower than 40%. The result indicated that the data had no severe common method variance problem (Harris et al., 2009).

Data analysis

The reliability test, descriptive statistical analysis, and correlation analysis of variables were performed using SPSS. Analysis of moment structures was conducted to perform confirmatory factor analysis. Latent variable structural equation modeling was adopted to evaluate the mediating effects.

RESULTS

Correlations and descriptive statistics

This study conducted descriptive statistical analysis and correlation analysis of the variables in all the dimensions, and the results are presented in Table 2. The four dimensions of authentic leadership (self-awareness, relational transparency, internalized moral morality, and balanced processing), the two dimensions of trust atmosphere (affect-based trust and cognition-based trust), and the two dimensions of innovative self-efficacy (problem solving ability and innovation ability) exhibited a significant positive correlation with the four dimensions of innovative behavior (modes of thinking, academic exploration, life practice, and academic study), with correlation coefficients ranging from 0.440 to 0.696, reaching the significance level of $p < 0.001$.

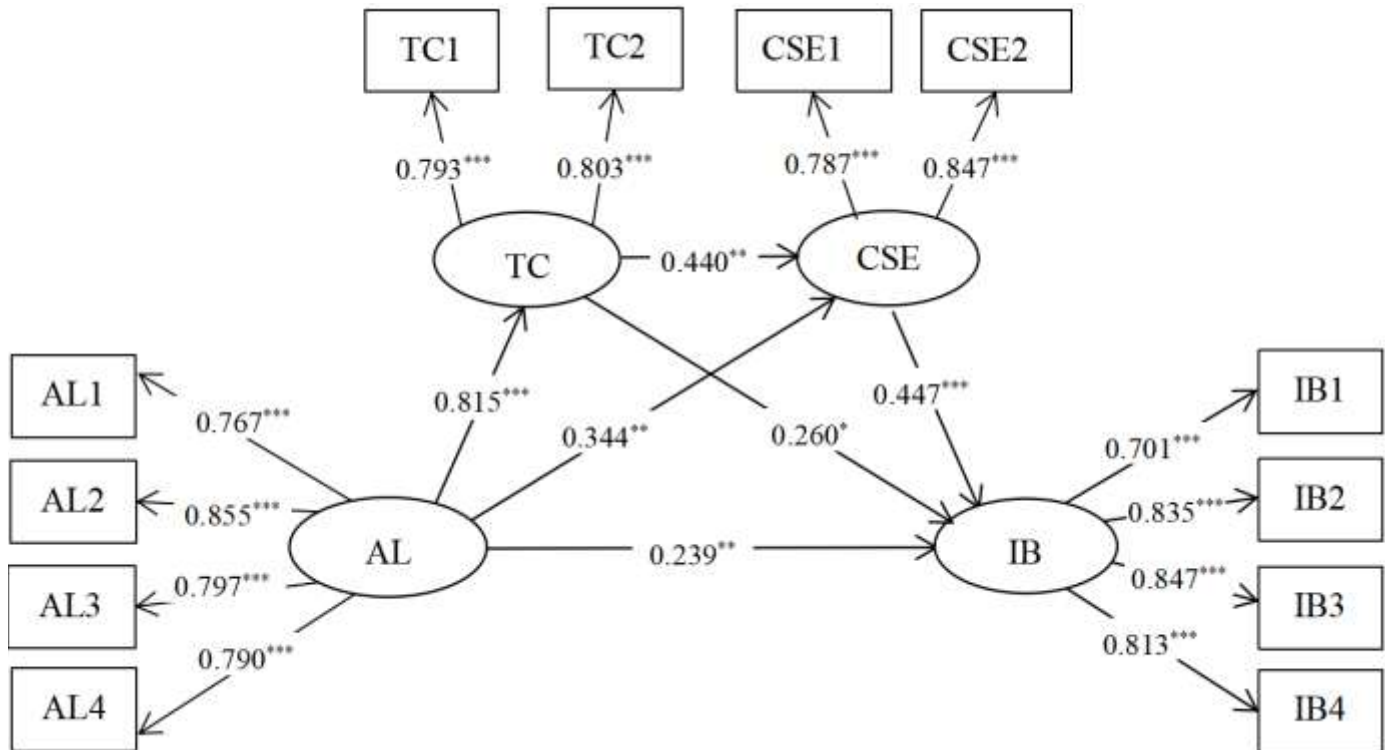


Figure 2. Mediating effects on the effect of college students' perceived authentic leadership on innovation behavior. The effect values in the table are standardized parameter values; AL=authentic leadership; TC=trust climate; CSE=creative self-efficacy; IB=innovation behavior; AL1= self-awareness; AL2=relational transparency; AL3=internalized moral perspective; AL4=balanced processing; TC1= affect-based trust; TC2=cognition-based trust; CSE1=problem solving ability; CSE2=innovation ability; IB1= modes of thinking; IB2=academic exploration; IB3=life practice; IB4=academic study, *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. Source: Author

Total effect

To assess the effect of college students' perceived authentic leadership on their innovation behavior, the present study developed a total effect model. The model fit indicators are as follows: $\chi^2/df = 6.940$, RMSEA = 0.074, SRMR = 0.038, CFI = 0.972, NFI = 0.968, GFI = 0.961, and TLI = 0.959, which suggest that the model has a good fit. The results revealed that college students' perceived authentic leadership significantly and positively influenced their innovation behavior ($\beta = 0.765$, $p < 0.001$). Thus, H1 was supported.

Mediating effect

On the basis of the total effect model, this study further tested the mediating effects of trust climate and creative self-efficacy. The model fit indicators are as follows: $\chi^2/df = 4.780$, RMSEA = 0.067, SRMR = 0.036, CFI = 0.971, NFI = 0.964, GFI = 0.954, and TLI = 0.960, which suggest that the model has a good fit. As shown in Figure 2, the results revealed that college students' perceived authentic leadership significantly and positively affected

innovation behavior ($\beta = 0.239$, $p < 0.01$). Moreover, the students' perceived authentic leadership significantly and positively influenced trust climate and creative self-efficacy ($\beta = 0.815$, $p < 0.001$; $\beta = 0.344$, $p < 0.01$). Furthermore, trust climate and creative self-efficacy significantly and positively influenced innovation behavior ($\beta = 0.260$, $p < 0.05$; $\beta = 0.447$, $p < 0.001$); and trust climate significantly and positively influenced creative self-efficacy ($\beta = 0.440$, $p < 0.01$).

This study further adopted a nonparametric percentile Bootstrap method (repeated sampling for 5000 times) to evaluate the mediating effect. The confidence interval (CI) was set at 95%. If the CI did not include 0, then the mediating effect was considered significant (Hayes, 2013).

Among the paths for the effect of college students' perceived authentic leadership on their innovation behavior, paths M1 (AL \rightarrow TC \rightarrow IB), M2 (AL \rightarrow CSE \rightarrow IB), and M3 (AL \rightarrow TC \rightarrow CSE \rightarrow IB) were significant, as shown in Table 3. The mediating effect size of paths M1, M2, and M3 was 0.212 (95% CI [0.054, 0.379]), 0.154 (95% CI [0.056, 0.298]), and 0.160 (95% CI [0.078, 0.295]), respectively. These values suggest that trust climate and creative self-efficacy have both single and

Table 3. Direct and indirect effects of college students' perceived authentic leadership on their innovation behavior.

Path	Estimation	Bootstrap 95% CI	
		Lower	Upper
Direct effects			
AL→IB	0.239	0.074	0.395
Indirect effects			
M1: AL → TC → IB	0.212	0.054	0.379
M2: AL → CSE → IB	0.154	0.056	0.298
M3: AL → TC → CSE → IB	0.160	0.078	0.295
Total effects			
AL→IB	0.765	0.717	0.809

ALQ=authentic leadership; TC=trust climate; CSE=creative self-efficacy; IB=innovation behavior.
Source: Author.

serial mediating effects on the effect of college students' perceived authentic leadership on their innovation behavior. Thus, H2–H4 is supported.

DISCUSSION

Theoretical contributions

The present study verified that college students' perceived authentic leadership significantly and positively influenced innovation behavior, thereby supporting H1. The results revealed that teachers' authentic leadership is a crucial factor that affected college students' innovation behavior, which is consistent with the results of previous studies (Yamak and Eyupoglu, 2021). Authentic leadership is an open and multi view leadership style, which enables teachers to express their authentic values and behavioral patterns to establish relationships with students. This leadership style helps students to obtain self-worth and a sense of satisfaction, which helps strengthen their psychological security and motivates them to propose their creative ideas (Claudia et al., 2012). In addition, studies have indicated that through authentic leadership, teachers can encourage students to express their authentic views and break routine ideas and therefore promote students' innovation behavior.

Trust climate had a partial mediating effect on the relationship between college students' perceived authentic leadership and innovation behavior, thereby supporting H2. These results indirectly support the results of previous empirical studies. Teachers' authentic leadership was reported to have a positive effect on the trust climate (Kulophas et al., 2015), and a favorable trust climate was found to improve students' innovation behavior (Leighton et al., 2016). We inferred that this effect mainly results from the role model effect of teachers' authentic leadership. As a positive leadership style, teachers' authentic leadership can provide students affective and cognitive support and improve the trust

climate. Studies have also indicated that a favorable trust climate encourages students to exchange ideas and help each other, which stimulates their innovation intention, thereby improving their innovation behavior.

Third, the results revealed that creative self-efficacy had a partial mediating effect on the relationship between college students' perceived authentic leadership and their innovation behavior, thereby supporting H3. Thus, teachers' authentic leadership can improve students' innovation behavior by improving their creative self-efficacy. The results of the present study also indirectly support previous empirical results that teachers' authentic leadership had a positive effect on creative self-efficacy (Srivastava et al., 2022) and that creative self-efficacy is a crucial factor that affected college students' innovation behavior (Chen et al., 2022). Teachers' authentic leadership may provide students more space to improve their skills, increase their confidence in performing creative activities, and enhance their creative self-efficacy; Moreover, the increase in creative self-efficacy strengthens students' confidence in facing difficulties and challenges, thereby increasing their innovation behavior.

Finally, this study further identified that college students' perceived authentic leadership affects innovation behavior through the serial mediating effect of trust climate and creative self-efficacy, supporting H4. This result can be explained using social cognitive theory, which states that behavioral factors (innovation behavior) are affected by environmental factors (teachers' authentic leadership and trust climate) and individual factors (creative self-efficacy). Teachers' authentic leadership refers to the presentation of teachers' authentic self to the students, which facilitates the development of trust relationships with students and creation of a favorable trust climate (Algera and Lips-Wiersma, 2012). A favorable trust climate enables students to communicate with each other and exchange new ideas, strengthens their creative belief, and increases their creative self-efficacy. Moreover, students with high creative self-efficacy have greater confidence and can respond to

problems that they may encounter while learning with a positive mindset, which further enhances their innovation behavior. The result expounds the mechanism underlying the effect of college students' perceived authentic leadership on their innovation behavior and provides a new perspective for subsequent studies.

Practical significance

Based on the results, the present study provides the following suggestions for leaders and teachers in higher education institutions. First, because college students' perceived authentic leadership was shown to significantly improve their innovation behavior, cultivating teachers' authentic leadership behavior is critical. Leadership training can improve individual leadership behavior (Zhang et al., 2015). Therefore, higher education institutions should focus on cultivating teachers' authentic leadership behavior through targeted training that will equip them to guide students with a confident and optimistic attitude, thereby promoting students' innovation behavior. In addition, higher education institutions should encourage teachers to establish sincere and authentic relationships with students and strive to build a harmonious school culture.

Second, this study revealed that trust climate had a partial mediating effect on the effect of college students' perceived authentic leadership on their innovation behavior. Therefore, to improve the innovation behavior of college students, teachers should strive to improve the trust climate by creating more opportunities for communication with the students, understanding the difficulties they encounter, and providing necessary support. In addition, teachers can develop team training activities to encourage students to help each other and enhance their mutual trust (Nam, 2014), which, in turn, will promote the generation of innovation behavior.

Third, because creative self-efficacy had a partial mediating effect on the relationship between college students' perceived authentic leadership and innovation behavior, teachers should focus on cultivating and stimulating confidence in college students, establishing effective reward and incentive mechanisms to motivate the students to propose innovative ideas, and enhancing the students' creative self-efficacy. In addition, teachers should include innovative classroom teaching activities such as group discussions and innovation and entrepreneurship competitions to cultivate college students' creative thinking and further enhance their creative self-efficacy and innovation behavior.

Finally, this study verified that trust climate and creative self-efficacy had a serial mediating effect on the relationship between college students' perceived authentic leadership and their innovation behavior. Teachers' authentic leadership can help build a favorable trust climate, which improves the students' creative self-

efficacy and ultimately their innovation behavior. The results implied that higher education institutions should especially consider the effect of trust climate and help teachers understand the concept. Therefore, we recommend that higher education institutions not only train the teachers in exhibiting authentic leadership behavior but also enhance communication with students through popular social media platforms (e.g., WeChat official account, Weibo, and TikTok), symposia, and other means. Moreover, they should address the needs of college students in a timely manner and actively provide care and support to the students. These measures will enable the creation of a favorable atmosphere of trust as well as enhance the creative self-efficacy of the students and promote their innovation behavior.

Conclusion

The present study established a serial mediation model to explore the effect of college students' perceived authentic leadership on their innovation behavior. The results revealed that college students' perceived authentic leadership significantly and positively influenced their innovation behavior. Trust climate and creative self-efficacy had partial as well as serial mediating effects on the relationship between college students' perceived authentic leadership and their innovation behavior.

LIMITATIONS AND FUTURE DIRECTIONS

The present study confirmed the effect of college students' perceived authentic leadership of the teacher on the students' innovation behavior and revealed the mechanism underlying this effect. Nevertheless, the study had the following limitations. First, because the study sample included students from six higher education institutions in Hebei Province, China, the generalizability of the research results is limited. Future studies could consider expanding the geographical area of sampling to increase the generalization of the results. Second, this study adopted a cross-sectional design. Therefore, although the study identified the influential relationship among the variables, it could not determine the causal relationship between the variables. Longitudinal and experimental studies in the future could determine the causality of the variables. Finally, the study identified that trust climate and creative self-efficacy had partial mediating effects on the effect of college students' perceived authentic leadership on their innovation behavior. This result implied that the mechanism underlying this effect may involve other latent mediating factors. Therefore, future studies could focus on exploring additional mediating factors or possible moderating factors that may have theoretical and practical implications on the improvement of college students'

innovation behavior.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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