ORIGINAL RESEARCH

Effects of Empathy on Loneliness Among Rural Left-Behind Children in China: The Chain-Mediated Roles of Social Anxiety and Psychological Resilience

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Objective: Loneliness is a prevalent issue among rural left-behind children in China, adversely affecting their physical and mental well-being, as well as social stability. However, the influencing factors and potential mechanisms of loneliness have not yet been fully clarified. This study aims to validate the mediating roles of social anxiety and psychological resilience by examining the association between affective/cognitive empathy and loneliness among Chinese rural left-behind children.

Methods: This cross-sectional survey employed a convenience sampling approach among Chinese left-behind children. A total of 540 participants aged 6 to 11 years old (Average age = 8.54, SD = 1.682) from 3 primary schools in Hunan Province completed the Children's Loneliness Scale, Social Anxiety Scale for Children, The Chinese version of Connor-Davidson Resilience Scale, and Basic Empathy Scale. Data analysis was conducted using SPSS 27.0, Origin 2020, and Mplus 8.3.

Results: Pearson correlation analyses suggested strong significant correlations among affective/cognitive empathy, loneliness, social anxiety, and psychological resilience. Path analyses indicated that the chain mediation effect size of social anxiety and psychological resilience was 0.016 between affective empathy and loneliness, while the chain mediation effect size between cognitive empathy and loneliness was −0.011.

Conclusion: Affective empathy positively correlates with loneliness among Chinese left-behind children through social anxiety and resilience, while cognitive empathy negatively correlates with loneliness. These findings suggest that left-behind children should enhance their cognitive empathy and psychological resilience to reduce their social anxiety, thereby mitigating their loneliness.

Keywords: left-behind children, empathy, loneliness, social anxiety, resilience

Introduction

Rural left-behind children (RLBC) in China are a result of the country's rapid economic growth. As income disparities between urban and rural areas persist, many rural parents move to cities for work, leaving their children in the care of elderly relatives. According to the 2020 National Population Census, there are 41.77 million RLBC in China, making up 14.03% of the child population, and this number continues to rise with urbanization. Without sufficient parental guidance and emotional support, RLBC face stressful environments that can lead to physical, psychological, and behavioral challenges,[1] making them more vulnerable to developmental issues than their peers who are not left behind.[2]

Loneliness is described as the distressing feeling that arises when there is a gap between the relationships one desires and those they actually have.[3] RLBC, who often lack emotional and psychological support due to parental absence, tend to develop more solitary personalities. This change negatively affects their interactions with peers, making them more prone to loneliness.[4] Studies show that loneliness is a common experience among left-behind children, with a rate 10.63% higher than that of non-left-behind children.[4,5] Childhood loneliness is also linked to psychiatric issues like

conduct problems, hyperactivity, emotional difficulties,[6] depression, anxiety,[7] and, in severe cases, suicide.[8] Given these negative outcomes, it is crucial to explore the factors and mechanisms behind loneliness to develop effective interventions for RLBC.

Another significant challenge for left-behind children is social anxiety, with a prevalence rate of 36.1% among RLBC in China, compared to 20.2% in non-left-behind children.[9] Research has shown that psychological resilience helps protect the mental health and social development of left-behind children, reducing the impact of negative factors.[10] Empathy, a positive psychological trait, has also been linked to mental health issues like loneliness[11] and anxiety.[12] However, there has been little systematic research exploring the relationships between these four factors. To address this gap, this study developed a chain mediation model to conduct a cross-sectional analysis, aiming to fully understand the connections between these variables for the first time.

Empathy and Loneliness

The existing literature shows that the loneliness of RLBC is influenced by various factors, including self-worth, personality traits, emotional intelligence, rumination, peer relationships, parent–child relationships, teacher–student relationships, and social exclusion.[13] Empathy, the ability to understand and share others' emotions, is generally seen as a positive psychological trait. It helps improve social adaptation and prevent antisocial behavior.[14,15] Research suggests that higher empathy is linked to lower loneliness,[11,16] as reduced empathy can lead to less emotional awareness, apathy, reduced social engagement, and increased loneliness. However, recent studies have also found that empathy is positively linked to anxiety and interpersonal distress among RLBC.[17] This is because empathy can increase the risk of personal distress and guilt, as excessive sympathy for others' negative emotions may lead to feelings of depression and anxiety. The specific relationship between empathy and loneliness in RLBC has not been fully explored. Based on previous research, it is speculated that affective empathy (AE) might increase loneliness in RLBC, while cognitive empathy (CE) might reduce it. Therefore, this study aims to investigate the potential link between empathy and loneliness in Chinese RLBC.

The Mediation of Social Anxiety

Social anxiety (SA) is an irrational fear experienced during social interactions, where individuals are anxious about being observed, judged, or evaluated by others.[18] SA is a common issue among RLBC,[9] often leading to reluctance to talk or socialize. They may fear doing something embarrassing, like speaking to strangers or eating in public. Research shows that social anxiety is linked to loneliness,[19,20] with those experiencing higher levels of social anxiety often feeling more lonely, particularly among RLBC. This may be because these children avoid social interactions to reduce anxiety. According to the social need theory of loneliness, when their need for communication is unmet, they are more likely to feel lonely.[7] Additionally, studies show that cognitive empathy is negatively correlated with social anxiety,[12] meaning better understanding of others' emotions can reduce anxiety in social situations. Conversely, affective empathy is positively correlated with social anxiety, possibly due to interpersonal guilt from excessive empathy, leading to despair and anxiety.[17] Based on these findings, this study suggests that social anxiety may mediate the relationship between empathy and loneliness.

The Mediation of Psychological Resilience

Another mediating variable in this study is psychological resilience (PR), which refers to an individual's ability to positively adapt and develop despite experiencing severe stress and adversity.[21] PR has long been recognized as beneficial for children facing difficult circumstances.[22] Research shows that psychological resilience not only helps to buffer the negative effects of challenges like being left behind but also promotes positive adaptation and growth.[23] Studies on RLBC have found a negative correlation between psychological resilience and loneliness, suggesting that increasing positive cognitive factors and family support can help reduce loneliness in these children.[24] Additionally, there is a strong link between empathy and psychological resilience. Positive empathy helps individuals navigate social interactions effectively, enabling them to face challenges with optimism and confidence, which in turn strengthens

psychological resilience.[25] Based on this evidence, it is reasonable to suggest that psychological resilience may also mediate the relationship between empathy and loneliness among RLBC.

The Chain Mediation of Psychological Resilience and Social Anxiety

As noted earlier, psychological resilience and social anxiety may each act as mediators between empathy and loneliness in RLBC. However, this study explores whether a chain mediation exists between them when they both serve as intermediaries. Previous research has shown that psychological resilience in rural college students with left-behind experiences is negatively correlated with social anxiety.[26] Those with strong psychological resilience are better at self-regulation and can effectively use internal and external resources when facing negative events and stress.[27] This helps them manage interpersonal communication challenges, reducing their social anxiety. Based on this, the study hypothesizes that psychological resilience and social anxiety together play a chain mediating role between empathy and loneliness in RLBC.

In summary, this study aims to investigate the correlation between affective/cognitive empathy and loneliness among RLBC in China and to examine whether psychological resilience and social anxiety serve as chain mediators in this relationship. The hypotheses are as followed (see Figure 1): 1) Psychological resilience mediates the relationship between affective empathy and loneliness; 2) Psychological resilience mediates the relationship between cognitive empathy and loneliness; 3) Social anxiety mediates the relationship between affective empathy and loneliness; 4) Social anxiety mediates the relationship between cognitive empathy and loneliness; 5) Psychological resilience and social anxiety collectively act as chain mediators between affective empathy and loneliness among RLBC; 6) Psychological resilience and social anxiety collectively act as chain mediators between cognitive empathy and loneliness among RLBC.

Materials and Methods
Participants and Procedure

Hunan Province has one of the highest numbers of left-behind children in China. Therefore, a questionnaire survey was carried out using convenience sampling method from three public primary schools in Hunan province. The selected schools were all located in rural areas. The study involved distributing questionnaires to a total of 597 students from
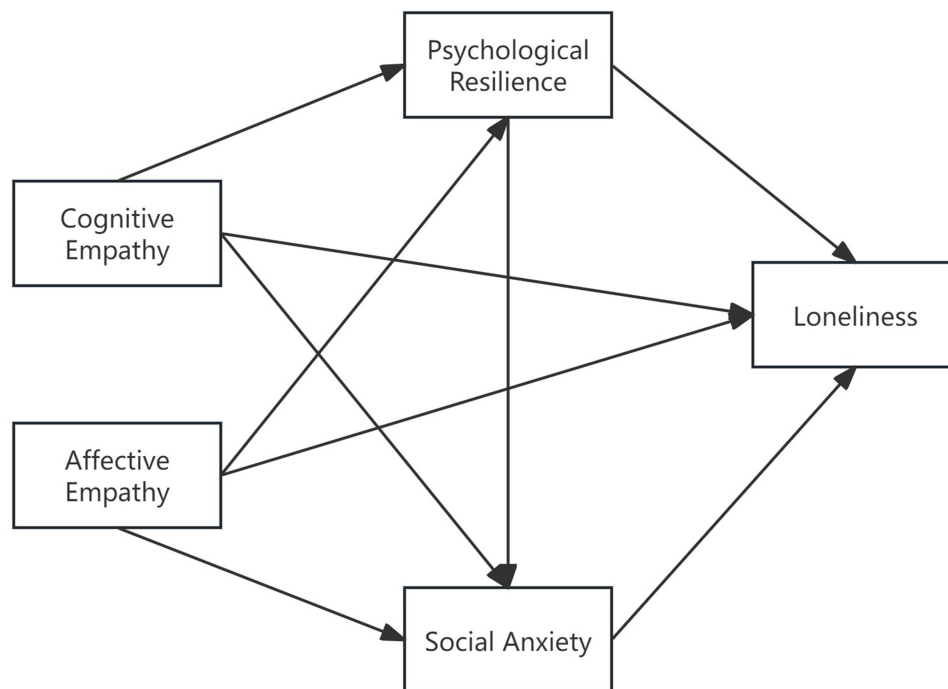

Figure 1 Hypothesized model of psychological resilience and social anxiety between affective/cognitive empathy and loneliness.

April 2022 to June 2022. The survey was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board of the School of Physical Education at Hunan Normal University. During the process, written informed consent of all participants' parents or guardians has been obtained. To ensure confidentiality and data integrity, an immediate on-site recycling process was implemented upon questionnaire completion. After excluding duplicated or inconsistently answered questionnaires, a final valid sample of 540 questionnaires was obtained, with a recovery rate of 90.45%. The participants included 286 male and 254 female students distributed across the six school years (85 in year one, 84 in year two, 94 in year three, 93 in year four, 98 in year five, 86 in year six). The mean age of the participants was 8.54 years old (SD = 1.682, range = 6–11 years).

Instruments

The formal questionnaire employed in this research comprises two principal sections. The first section was a socio-demographic collection about the participants, encompassing gender, age, and grade level. The subsequent section incorporates well-established scales, including empathy, loneliness, psychological resilience, and social anxiety.

Loneliness

Children's Loneliness Scale was developed by Asher,[28] consists of 16 items (eg, It is hard for me to make friends). The way of scoring each response is a 5-point scale (from "1 = never" to "5 = always"). Individuals who get high score of this scale may have high levels of loneliness. This scale has been proven to have good validity and reliability among RLBC.[24] In this study, the total score was used to represent the loneliness level of RLBC, and the Cronbach's α coefficient of the scale was 0.722.

Social Anxiety

Social Anxiety Scale for Children was developed by La Greca,[29] consists of 10 items, including subscales of fear of negative evaluation (eg, I am afraid of being teased) and social avoidance and distress (eg, I feel nervous when talking to strange children). The way of scoring each response is on a 3-point scale (from "0 = never" to "2 = always"). Individuals who get higher scores may suffer higher levels of social anxiety. This scale has been proven to have good validity and reliability among RLBC.[30] In this study, the Cronbach's α coefficient of the scale was 0.817.

Psychological Resilience

The Chinese version of Connor-Davidson Resilience Scale was modified by Yu Xiaonan,[31] consists of 25 items, including three dimensions, namely tenacity (eg, when things look hopeless, I do not give up), strength (eg, tend to bounce back after illness or hardship), and optimism (eg, see the humorous side of things). Each item is scored on a 5-point scale (from "0=not true" at all 4 = true nearly all of the time). Higher scores indicate better psychological resilience. The Chinese version of this scale has been proven to have good validity and reliability.[32] In this study, the Cronbach's α coefficient of the scale was 0.901.

Empathy

Basic Empathy Scale was developed by Darrick,[33] consists of 20 items, including subscales of affective empathy (eg, After being with a friend who is sad about something, I usually feel sad') and cognitive empathy (eg, when someone is feeling down, I can usually understand how s/he feels). The way of scoring each response is a 5-point scale (from "1 = completely disagree" to "5 = completely agree"). Individuals who get higher scores may acquire higher levels of empathy. The Chinese version of this scale has been proven to have good validity and reliability.[34] In this study, the Cronbach's α coefficient of the scale was 0.880.

Statistical Analyses

The research analyzed the collected data using SPSS 27.0, Origin 2020, and Mplus 8.3, with a significance level set at 0.05. Harman's single-factor test method was utilized to examine the presence of common bias within the research data. Unrotated principal component analysis, conducted on the variable measurement questions using the SPSS 27.0 software, revealed that the first principal component accounted for 30.24% of the total variation, falling below the critical value of

40%. This suggests that common method deviation did not exert a significant impact on the study's results. Origin 2020 was performed to explore the relationships among affective/cognitive empathy, social anxiety, psychological resilience, and loneliness. The continuous variables of the normal distribution were expressed as mean ± standard deviation (*SD*). Mplus 8.3 was mainly used for testing the mediation roles of social anxiety and psychological resilience. This study utilized the sequential test method to scrutinize the mediating impact of psychological resilience and social anxiety on the relationship between affective/cognitive empathy and loneliness. The mediating effect was examined with 5000 bias corrected bootstrapping and 95% percentile confidence intervals (*CI*). The effect is statistically significant if the *CI* does not include zero.

Results and Analysis
Descriptive Statistics and Correlation Analysis
As shown in Table 1 and Figure 2, the correlation coefficients of empathy, social anxiety, psychological resilience, and loneliness were statistically significant. Cognitive empathy presented a negative correlation with social anxiety ($r = -0.41$, $p < 0.01$) and loneliness ($r = -0.42$, $p < 0.01$), while affective empathy presented a positive correlation with social anxiety ($r = 0.51$, $p < 0.01$) and loneliness ($r = 0.57$, $p < 0.01$). Cognitive empathy presented a positive correlation with psychological resilience ($r = 0.40$, $p < 0.01$), while affective empathy presented a negative correlation ($r = -0.45$, $p < 0.01$). Social anxiety presented a negative correlation with psychological resilience ($r = -0.59$, $p < 0.01$) and a positive correlation with loneliness ($r = 0.52$, $p < 0.01$). Psychological resilience presented a negative correlation with loneliness ($r = -0.61$, $p < 0.01$). The relationship between variables supports subsequent hypothesis testing. Red indicating positive correlations and blue indicating negative correlations. The depth of color represents the strength of the correlation.

Hypothesis Testing
The Mediation Effect of Psychological Resilience
The study constructed two models to examine the mediating effect of psychological resilience. Table 2 presents the mediating role of psychological resilience between affective empathy and loneliness. The total effect is 0.570, with a 95% *CI* of (0.505, 0.636). The indirect effect is 0.201, with a 95% *CI* of (0.294, 0.445). The mediating effect contributes to 35.2% of the total effect, indicating that psychological resilience plays a partial mediating role between affective empathy and loneliness. Table 2 presents the mediating role of psychological resilience between cognitive empathy and loneliness. The total effect is quantified at −0.404, with a 95% *CI* of (−0.458, −0.349). The indirect mediation is −0.208, with a 95% *CI* of (−0.254, −0.162). The mediating effect contributes to 51.5% of the total effect, indicating the partial mediation of psychological resilience between cognitive empathy and loneliness. These findings provide substantial evidence for Hypotheses 1 and 2.

The Mediation Effect of Social Anxiety
Similarly, the study constructed two models to examine the mediating role of social anxiety between affective/cognitive empathy and loneliness. As shown in Table 3, the total effect is 0.570, with a 95% *CI* of (0.505, 0.636), while the indirect effect is 0.160, with a 95% *CI* of (0.118, 0.202). The results suggest that social anxiety plays a mediating role between

Table 1 Correlation Coefficient Matrix of Research Variables

Variables	Mean	SD	CE	AE	SA	PR	Loneliness
CE	30.85	13.14	1				
AE	25.48	6.47	−0.41**	1			
SA	8.46	2.56	−0.41**	0.51**	1		
PR	61.82	12.49	0.40**	−0.45**	−0.59**	1	
Loneliness	38.31	8.67	−0.42**	0.57**	0.52**	−0.61**	1

Note: **$p < 0.01$.
Abbreviations: SD, indicates standard deviation; CE, indicates cognitive empathy; AE, indicates affective empathy; SA, indicates social anxiety; PR, indicates psychological resilience.
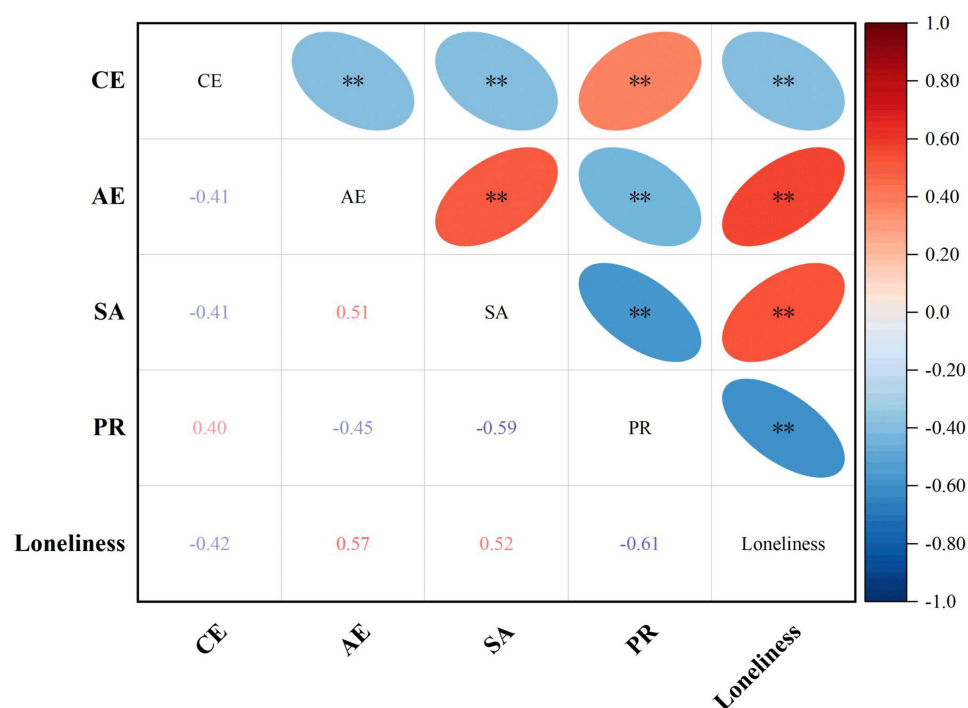
Figure 2 Correlation coefficient matrix of research variables.
Note: **$p < 0.01$. CE indicates cognitive empathy, AE indicates affective empathy, SA indicates social anxiety, PR indicates psychological resilience.

affective empathy and loneliness, with the mediating effect accounting for 28.1% of the total effect. The total effect between cognitive empathy and loneliness is −0.404, with a 95% *CI* of (0.458, −0.349), while the indirect effect is −0.175, with a 95% *CI* of (−0.213, −0.137). The mediating effect contributes to 43.3% of the total effect, indicating the partial mediation of social anxiety between cognitive empathy and loneliness. These findings also support Hypotheses 3 and 4.

Testing for the Chain Mediating Model
After independently examining the mediating effects of psychological resilience and social anxiety, this research proceeded to explore the interconnected mediating effects of these two variables as mediators in two models. One involving "affective empathy—psychological resilience—social anxiety—loneliness" and the other "cognitive empathy —psychological resilience—social anxiety—loneliness". In Table 4, the total effect between affective empathy and

Table 2 Psychological Resilience Bootstrap Mediation Effect Tests in Affective Empathy and Cognitive Empathy

Path	Effect size	Bias-corrected 95% CI		Effect Ratio
		Lower	Upper	
Affective empathy				
Total effect	0.570	0.505	0.636	
Direct effect	0.370	0.161	0.241	64.8%
Indirect effect	0.201	0.294	0.445	35.2%
Cognitive empathy				
Total effect	−0.404	−0.458	−0.349	
Direct effect	−0.195	−0.252	−0.139	48.5%
Indirect effect	−0.208	−0.254	−0.162	51.5%

Note: All coefficients are standardized, and the following empirical data are standardized results.

Table 3 Social Anxiety Bootstrap Mediation Effect Tests in Affective Empathy and Cognitive Empathy

Path	Effect size	Bias-corrected 95% CI		Effect Ratio
		Lower	Upper	
Affective empathy				
Total effect	0.570	0.505	0.636	
Direct effect	0.410	0.328	0.492	71.9%
Indirect effect	0.160	0.118	0.202	28.1%
Cognitive empathy				
Total effect	−0.404	−0.458	−0.349	
Direct effect	−0.229	−0.288	−0.169	56.7%
Indirect effect	−0.175	−0.213	−0.137	43.3%

Table 4 Test of Chain Mediation Effect in Affective Empathy and Cognitive Empathy

Path	Effect size	Bias-corrected 95% CI		Effect Ratio
		Lower	Upper	
Affective empathy				
Total effect	0.486	0.405	0.568	
Direct effect	0.311	0.348	0.500	63.9%
Indirect effect	0.176	0.132	0.220	36.1%
AE→PR→Loneliness	0.131	0.092	0.170	26.9%
AE→SA→Loneliness	0.029	0.008	0.050	5.9%
AE→PR→SA→Loneliness	0.016	0.005	0.026	3.4%
Cognitive empathy				
Total effect	−0.210	−0.272	−0.147	
Direct effect	−0.090	−0.152	−0.029	43.3%
Indirect effect	−0.119	−0.164	−0.074	56.7%
CE→PR→Loneliness	−0.093	−0.133	−0.053	44.3%
CE→SA→Loneliness	−0.015	−0.027	−0.003	7.3%
CE→PR→SA→Loneliness	−0.011	−0.019	−0.003	5.2%

loneliness is significant (β = 0.486, 95% *CI*: 0.405, 0.568). The indirect effect of the pathway with psychological resilience and social anxiety as mediating variables is also significant (β = 0.016, 95% *CI*: 0.005, 0.026). This chain mediation effect accounts for 3.4% of the total effect. Meanwhile, the total effect between cognitive empathy and loneliness is significant (β = −0.210, 95% *CI*: −0.272, −0.147). The indirect effect of pathway with psychological resilience and social anxiety as mediating variables is also significant (β = −0.011, 95% *CI*: −0.019, −0.003). This chain mediation effect accounts for 5.2% of the total effect. These foundings support the validity of Hypothesis H5 and H6. Figure 3 presents the final chain intermediary model effect.

Discussion

This study examines how affective and cognitive empathy relate to loneliness among RLBC, and how psychological resilience and social anxiety mediate these relationships using chain mediation models. The results showed that cognitive empathy is linked to lower loneliness, while affective empathy is associated with higher loneliness. This supports previous research,[35] which found that affective empathy is tied to negative emotions, whereas cognitive empathy is
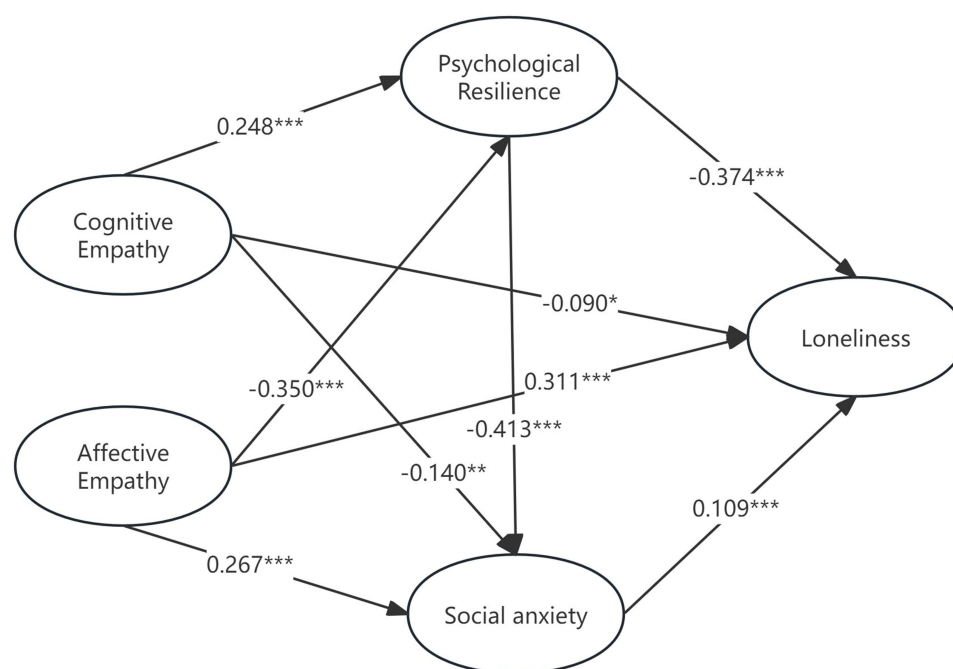
Figure 3 Mediating roles of psychological resilience and social anxiety between affective/cognitive empathy and loneliness. *p < 0.05, **p < 0.01, ***p < 0.001.

linked to fewer depressive feelings. Our findings help clarify conflicting results from earlier studies on empathy and loneliness. Some research suggested a positive link between empathy and loneliness,[36–38] while others found a negative correlation.[11,16,39] Specifically, our results indicate that high affective empathy in left-behind children makes them more sensitive to others' emotions, leading to greater loneliness.[40] In contrast, high cognitive empathy helps children understand others' emotions without being overwhelmed by them, reducing their loneliness.[41]

Our findings highlight the important role of psychological resilience in how affective and cognitive empathy affect loneliness among RLBC. We found that high emotional empathy is linked to lower psychological resilience and increased loneliness. In contrast, RLBC with strong cognitive empathy and high psychological resilience experience less loneliness. This supports earlier research,[42] which suggests that excessive affective empathy can lead to negative feelings like shame and self-blame,[43] reducing psychological resilience.[44] This makes emotional regulation harder and increases loneliness. On the other hand, people with higher cognitive empathy tend to feel more supported and satisfied in their relationships,[45] which helps them handle adversity better and reduces loneliness. For RLBC, high affective empathy means they often feel the emotional pain of others, which can negatively affect their mental health.

The study also shows that social anxiety plays a key role in how affective and cognitive empathy affect loneliness among RLBC. We found that children with high affective empathy often have higher social anxiety and loneliness. This is because they may struggle to manage their own emotions, which increases their sensitivity and fear in social situations.[17,46,47] On the other hand, children with high cognitive empathy tend to have lower social anxiety and loneliness. This is because cognitive empathy helps them understand others' feelings better and handle social situations more flexibly,[48] reducing their fear of rejection. This trait helps to reduce interpersonal rejection, help individuals adapt to social situations, and negatively predict their social anxiety and loneliness. Children who lack cognitive empathy may have trouble understanding others and feel more anxious and confused in social interactions, which increases their loneliness.[49,50]

Our study reveals that psychological resilience and social anxiety act as chain mediators between affective and cognitive empathy and loneliness among RLBC, supporting our hypotheses. We found that RLBC with high affective empathy often experience more loneliness, which may be due to lower psychological resilience and higher social anxiety. In contrast, RLBC with high cognitive empathy tend to feel less lonely, likely because they have better psychological resilience and lower social anxiety. Our findings also underscore the negative correlation between psychological resilience and social anxiety, aligning with prior research.[26,51,52] RLBC with strong psychological resilience generally have better self-esteem,

self-efficacy, and social skills, which helps reduce social anxiety. Consequently, RLBC with robust psychological resilience tend to exhibit lower levels of social anxiety. In summary, our study underscores the pivotal protective role played by psychological resilience in mitigating the impact of empathy, social anxiety, and loneliness among RLBC. This is particularly salient in contexts marked by heightened affective empathy,[14] loneliness,[5] and social anxiety[9] among this vulnerable population. To effectively address loneliness among RLBC, it is crucial to develop targeted interventions that enhance psychological resilience and social skills.[53] Programs focusing on building self-esteem, promoting positive self-evaluations, and teaching effective coping strategies can be instrumental. Additionally, interventions designed to foster healthy social interactions and reduce social anxiety may help alleviate loneliness.[54] For instance, social skills training and group therapy that encourage positive peer interactions could be beneficial.[55]

Research Deficiencies and Future Directions

Several limitations should be considered when interpreting the results of this study. Firstly, owing to its cross-sectional design, establishing definite casual relationships between variables is not possible. In future studies, researchers could use longitudinal follow-up or experimental interventions to provide a more thorough understanding of how empathy, psychological resilience, and social anxiety affect loneliness of RLBC. Secondly, due to time and energy constraints, the study primarily employs the self-reported questionnaires, lacking in-depth interviews with participants. In future researches, researchers could consider using a combination of quantitative and qualitative research methods to collect diverse data and materials, contributing to a richer analysis of the phenomena under investigation. Thirdly, while the sample size meets statistical criteria, the geographical distribution coverage is limited, confined to only in Hunan Province. Future investigations should broaden the sampling area to enhance the generalizability of research findings and derive more robust conclusions. Lastly, the study did not consider the demographic variations, such as gender, sex, and income level, which may significantly influence the relationships between affective/cognitive empathy, loneliness, psychological resilience, and social anxiety. Future studies should prioritize investigating the interaction between these demographic factors and the aforementioned variables.

Conclusion

The primary objective of this study was to explore how cognitive and affective empathy influence loneliness among RLBC and to identify the mediating roles of psychological resilience and social anxiety. The study confirms that cognitive empathy is associated with lower levels of loneliness, while affective empathy is linked to higher levels of loneliness. Additionally, we found that psychological resilience and social anxiety mediate the relationship between empathy and loneliness, providing insight into the mechanisms by which empathy impacts loneliness. In light of these findings, it is crucial for educators, parents, and researchers to focus on enhancing cognitive empathy and psychological resilience in RLBC while carefully managing the development of affective empathy. This approach could help reduce feelings of loneliness and social anxiety among these children. Encouraging positive self-perception, fostering healthy emotional development, and engaging RLBC in educational, cultural, and recreational activities are recommended strategies to build their psychological resilience and improve their social and emotional well-being.

Data Sharing Statement

The datasets generated for this study are available on request to the corresponding authors.

Ethics Approval

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of the School of Physical Education at Hunan Normal University (reference: 2022 No. 309).

Informed Consent

Written informed consent was obtained from all individual participants and their parents included in the study.

Funding

A portion of this study was supported by a grant from the Social Science General Project of Hunan Province(Project number: 23YBA072).

Disclosure

Xue Li and Dianhui Peng contributed to the work equally and should be regarded as co-first authors. The authors report no conflicts of interest in this work.

References

1. Shi X-L, X-M L, Jiang B-C, Fan F. Longitudinal mediating role of psychological resilience between insecure attachment and mental health problems in left-behind children: a follow-up study. *Chin J Clin Psychol*. 2023;31(06):1375–1379. doi:10.16128/j.cnki.1005-3611.2023.06.016
2. Wang X-Q, Huo J-S, Zhang D-J, Liu P-J. The relationship between mental health and child abuse and their difference between left-at-home children and those living with their parents in rural areas: an analysis based on the two dimensional four-fact mental health structure. *Chin J Special Edu*. 2018;211(01):58–64.
3. Perlman D, Peplau LA. Theoretical approaches to loneliness. *Loneliness*. 1982;36:123–134.
4. Zhang T-P-M, Shi Z-L. The influence of parents' migration for work on the rural left-behind children's mental health. *Northwest Pop J*. 2021;42 (04):31–43. doi:10.15884/j.cnki.issn.1007-0672.2021.04.004
5. Xiong Y, Li X, Li H, et al. A meta-analysis of loneliness among left-behind children in China. *Curr Psychol*. 2023;1–9.
6. Lempinen L, Junttila N, Sourander A. Loneliness and friendships among eight-year-old children: time-trends over a 24-year period. *J Child Psychol Psychiatry*. 2018;59(2):171–179. doi:10.1111/jcpp.12807
7. Zhang Y, Zhang S-L, Wang H-R. The relationship between self-esteem and depression of left-behind children in rural areas: multiple mediating effects of social anxiety and loneliness. *Mod Preventive Med*. 2024;51(01):55–59+87. doi:10.20043/j.cnki.MPM.202307431
8. Xue Y, Qiu L-H, Ji J-S. Investigation on influential factors of suicidal ideation among left-behind children. *J Clin Psychiatry*. 2019;29(04):225–228.
9. M-L L, Ren Y-J, Jiang F. A meta-analysis of social anxiety in left-behind children in rural areas of China. *Chin Mental Health J*. 2019;33 (11):839–844.
10. Bai -H-H, Wang Y-Q, Sun W-Q. The resilience status of left-behind children: a meta-analysis. *Stud Psychol Behav*. 2022;20(02):261–267.
11. Hu T, Zheng X, Huang M. Absence and presence of human interaction: the relationship between loneliness and empathy. *Front Psychology*. 2020;11:528843. doi:10.3389/fpsyg.2020.00768
12. Pittelkow -M-M, Aan Het Rot M, Seidel LJ, Feyel N, Roest AM. Social anxiety and empathy: a systematic review and meta-analysis. *Journal of Anxiety Disorders*. 2021;78:102357. doi:10.1016/j.janxdis.2021.102357
13. J-Y L, Tan T-B. Influencing factors and intervention strategies of loneliness in rural left-behind children. *J Campus Life & Mental Health*. 2020;18 (02):142–145. doi:10.19521/j.cnki.1673-1662.2020.02.019
14. Liu X-Y, Cui L-J. A study on the characteristics of left-behind children's empathic ability, development influencing factors and their intervention. *J Soochow Univ*. 2020;8(03):65–75. doi:10.19563/j.cnki.sdjk.2020.03.008
15. Detsomboonrat P, Theppanich S, Banyen S, et al. Empathy level towards patients among Thai dental students: a cross-sectional study. *BMC Oral Health*. 2023;23(1):184. doi:10.1186/s12903-023-02891-6
16. Beadle JN, Keady B, Brown V, Tranel D, Paradiso S. Trait empathy as a predictor of individual differences in perceived loneliness. *Psychol Rep*. 2012;110(1):3–15. doi:10.2466/07.09.20.PR0.110.1.3-15
17. Liu F, Dong Y, Yuan Y, Jiang Y. Relationship between empathy and interpersonal distress of Chinese left-behind children: the role of emotion regulation and gender. *Psychol Res Behav Manag*. 2023;16:3717–3726. doi:10.2147/PRBM.S406801
18. Morrison AS, Heimberg RG. Social anxiety and social anxiety disorder. *Annual Rev Clini Psychol*. 2013;9(1):249–274. doi:10.1146/annurev-clinpsy-050212-185631
19. Danneel S, Geukens F, Maes M, et al. Loneliness, social anxiety symptoms, and depressive symptoms in adolescence: longitudinal distinctiveness and correlated change. *J. Youth Adolesc*. 2020;49(11):2246–2264. doi:10.1007/s10964-020-01315-w
20. O'Day EB, Butler RM, Morrison AS, Goldin PR, Gross JJ, Heimberg RG. Reductions in social anxiety during treatment predict lower levels of loneliness during follow-up among individuals with social anxiety disorder. *J Anxiety Disorders*. 2021;78:102362. doi:10.1016/j.janxdis.2021.102362
21. J-Z X, Zuo Z-H, Wu W. Approaches to research on resilience. *Adv Psychol Sci*. 2012;20(9):1426.
22. Jatchavala C, Vittayanont A. Higher education in armed conflict region of southern Thailand: association between h.m King Bhumibol Adulyadej's Sufficiency Economy Philosophy and Resilience. *J Health Trans Med*. 2020:23.
23. Tan L-Z, Sun K-L, Chu W. Study on the influencing factors of psychological resilience of rural left-behind children. *Chin J Health Edu*. 2023;39 (09):858–863. doi:10.16168/j.cnki.issn.1002-9982.2023.09.015
24. Dong Z-S, Qi H, H-Y Y. Research on the lmpact of psychological resilience on the loneliness of left-behind children in ethnic minority areas in Guangxi. *Comparative Study Cult Innov*. 2020;4(25):10–12.
25. A-C L, Lu Y, Yang J-H. The effect of college students' empathic ability on malicious creativity: the mediating role of resilience. *Psycholo Month*. 2023;18(23):57–59+78. doi:10.19738/j.cnki.psy.2023.23.014
26. Liang J-S, Zhang -S-S, Wu Z. Relationship among social anxiety, emotional maltreatment and resilience in rural college students with left-behind experience. *Chin Mental Health J*. 2019;33(01):64–69.
27. Feng B, Li Z-L, Wang K-X, Cui H-B. The relationship between purpose in life and resilience in college students: The multiple mediating roles of self-control and general self-efficacy. *Psycholl Res*. 2022;15(01):78–85. doi:10.19988/j.cnki.issn.2095-1159.2022.01.010
28. Asher SR, Hymel S, Renshaw PD. Loneliness in children. *Child Development*. 1984;55(4):1456–1464. doi:10.2307/1130015

29. La Greca AM, Dandes SK, Wick P, Shaw K, Stone WL. Development of the social anxiety scale for children: reliability and concurrent validity. *J Clin Child Psycho*. 1988;17(1):84–91. doi:10.1207/s15374424jccp1701_11

30. Wang X, Zhang -L-L, Wu X-Q, Hu S. Relationship between social anxiety and loneliness in left-behind children: mediating roles of friendship quality and perceived discrimination. *J Bio-Education*. 2023;11(04):316–322.

31. X-N Y, Zhang J-X. A comparison between the Chinese version of ego-resiliency scale and Connor-Davidson Resilience Scale. *J Psycholo Sci*. 2007;(05):1169–1171. doi:10.16719/j.cnki.1671-6981.2007.05.035

32. Du P, Zhang Y-P. A study on the influence of school environment on the resilience of left-behind children. *ChiN Econom Edu Rev*. 2021;6 (02):24–45. doi:10.19512/j.cnki.issn2096-2088.2021.02.002

33. Jolliffe D, Farrington DP. Development and validation of the basic empathy scale. *J Adolescence*. 2006;29(4):589–611. doi:10.1016/j. adolescence.2005.08.010

34. Chen X-L, Zhang Y-Q, Ling Y-L. Association between parental alexithymia and children's empathy: the mediating role of parent-child attachment. *J Quanzhou nor Univ*. 2022;40(03):80–86. doi:10.16125/j.cnki.1009-8224.2022.03.016

35. Guo X-D, Zheng H, Yuan D, et al. Cognitive and affective empathy and negative emotions: mechanisms of emotion regulation. *Acta Psychologica Sinica*. 2023;55(06):892–904. doi:10.3724/SP.J.1041.2023.00892

36. Hasmujaj E. Loneliness and Empathy Among Educational Sciences Students: a Cross-sectional Study. *ACHIEVEMENTS CHALLENGES of SOCIAL WORK PROFESSION*. 2023.

37. Kalliopuska M. Empathy and the experiencing of loneliness. *Psychol Rep*. 1986;59(3):1052–1054. doi:10.2466/pr0.1986.59.3.1052

38. Decety J, Lamm C. The biological basis of empathy. *Handbook Neurosci Behav Sci*. NY: John Wiley and Sons New York; 2009;940–957.

39. Mwilambwe-Tshilobo L, Setton R, Bzdok D, Turner GR, Spreng RN. Age differences in functional brain networks associated with loneliness and empathy. *Network Neurosci*. 2023;7(2):496–521. doi:10.1162/netn_a_00293

40. Yan Z-Q, Li S. The association of empathy on depression: the moderating effect of peer-relationship. *Stud Psychol Behav*. 2021;19(03):424–430.

41. Yan Z-Q, Su J-L, Su Y-J. Empathy and sympathy or compassion: source, conception and measurement. *Stud Psychol Behav*. 2018;16(04):433–440.

42. Sun B-H, Jiang Y-R, Lou B-N, W-J L, Zhou X-Y. The mechanism of compassion fatigue among medical staffs: the mediated moderation model. *Psycholl Res*. 2014;7(01):59–65.

43. Tone EB, Tully EC. Empathy as a "risky strength": a multilevel examination of empathy and risk for internalizing disorders. *Dev. Psychopathol*. 2014;26(4pt2):1547–1565. doi:10.1017/S0954579414001199

44. Yan Z-Q, Zeng X, Zhu S, Chen L. The relationship between affective empathy and depression in adolescent: a chain mediating effect of shame and resilience. *Chin J Clin Psychol*. 2022;30(01):77–80. doi:10.16128/j.cnki.1005-3611.2022.01.016

45. Shi Y, Ni -Y-Y, X JI, Luo H, Ping -W-W. Influence of empathy on depression of clinical medical students: the chain mediating effect of peer relationship satisfaction and resilience. *China J Health Psychol*. 2021;29(02):305–309. doi:10.13342/j.cnki.cjhp.2021.02.031

46. Tong L-D, Jiang Z-Y. Relationship between interpersonal sensitivity and depression in individuals at the emerging adulthood: the chain-mediated role of social anxiety and rumination. *China J Health Psychol*. 2023;31(10):1564–1569. doi:10.13342/j.cnki.cjhp.2023.10.024

47. Rotenberg KJ, Hymel S. *Loneliness in Childhood and Adolescence*. Cambridge University Press; 1999.

48. Tan X, Yang Y, Yu M. Longitudinal relationship of empathy and social anxiety among adolescents: the mediation roles of psychological inflexibility and rejection sensitivity. *J Affective Disorders*. 2023;339:867–876. doi:10.1016/j.jad.2023.07.069

49. Chen H, He T, Tang Y-Q, Tang X-Y, Lu F-Y, Lin X-Y. The associations and pathways between empathy and adolescent internalizing and externalizing problems. *Psychological Develop Edu*. 2021;37(03):439–446. doi:10.16187/j.cnki.issn1001-4918.2021.03.15

50. Hezel DM, McNally RJ. Theory of mind impairments in social anxiety disorder. *Behav Ther*. 2014;45(4):530–540. doi:10.1016/j.beth.2014.02.010

51. C-YA K, Chang Y. Investigating the relationships among resilience, social anxiety, and procrastination in a sample of college students. *Psychol Rep*. 2019;122(1):231–245. doi:10.1177/0033294118755111

52. Lee S-E, Kim S-G, Kim SH, Park SH, Seo EH, Yoon H-J. Association of social anxiety disorder symptoms with self-esteem, ego-resiliency and social support in medical students. *Anxiety Mood*. 2020;16(2):98–105.

53. Eccles AM, Qualter P. Review: alleviating loneliness in young people – a meta-analysis of interventions. *Child Adolesc Men Health*. 2021;26 (1):17–33. doi:10.1111/camh.12389

54. Lin Y, Chen Z, He M, et al. The relationship between anxiety and depression in adolescent depression patients: the mediating effect of hope level and coping modes. *Heliyon*. 2024;10(15):e35466. doi:10.1016/j.heliyon.2024.e35466

55. Zhang M, Wang S, Wang Z, et al. Associations of affective and cognitive empathy with depressive symptoms among a sample of Chinese college freshmen. *J Affective Disorders*. 2021;292:652–659. doi:10.1016/j.jad.2021.05.111