frontiers | Research Topics

Causes and consequences of solitude in children and adolescents

Edited by
Junsheng Liu, Louis A. Schmidt and Xuechen Ding

Coordinated by
Xi Chen

Published in
Frontiers in Psychiatry
Frontiers in Psychology

ISSN 1664-8714
ISBN 978-2-8325-4428-0
DOI 10.3389/978-2-8325-4428-0

About Frontiers

Frontiers is more than just an open access publisher of scholarly articles: it is a pioneering approach to the world of academia, radically improving the way scholarly research is managed. The grand vision of Frontiers is a world where all people have an equal opportunity to seek, share and generate knowledge. Frontiers provides immediate and permanent online open access to all its publications, but this alone is not enough to realize our grand goals.

Frontiers journal series

The Frontiers journal series is a multi-tier and interdisciplinary set of open-access, online journals, promising a paradigm shift from the current review, selection and dissemination processes in academic publishing. All Frontiers journals are driven by researchers for researchers; therefore, they constitute a service to the scholarly community. At the same time, the *Frontiers journal series* operates on a revolutionary invention, the tiered publishing system, initially addressing specific communities of scholars, and gradually climbing up to broader public understanding, thus serving the interests of the lay society, too.

Dedication to quality

Each Frontiers article is a landmark of the highest quality, thanks to genuinely collaborative interactions between authors and review editors, who include some of the world's best academicians. Research must be certified by peers before entering a stream of knowledge that may eventually reach the public - and shape society; therefore, Frontiers only applies the most rigorous and unbiased reviews. Frontiers revolutionizes research publishing by freely delivering the most outstanding research, evaluated with no bias from both the academic and social point of view. By applying the most advanced information technologies, Frontiers is catapulting scholarly publishing into a new generation.

What are Frontiers Research Topics?

Frontiers Research Topics are very popular trademarks of the *Frontiers journals series*: they are collections of at least ten articles, all centered on a particular subject. With their unique mix of varied contributions from Original Research to Review Articles, Frontiers Research Topics unify the most influential researchers, the latest key findings and historical advances in a hot research area.

Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers editorial office: frontiersin.org/about/contact

Causes and consequences of solitude in children and adolescents

Topic editors
Junsheng Liu — East China Normal University, China
Louis A. Schmidt — McMaster University, Canada
Xuechen Ding — Shanghai Normal University, China

Topic coordinator
Xi Chen — East China Normal University, China

Citation
Liu, J., Schmidt, L. A., Ding, X., Chen, X., eds. (2024). *Causes and consequences of solitude in children and adolescents*. Lausanne: Frontiers Media SA.
doi: 10.3389/978-2-8325-4428-0

Table of contents

04 Editorial: Causes and consequences of solitude in children and adolescents
Xi Chen, Junsheng Liu, Louis A. Schmidt and Xuechen Ding

07 Unsociability and social adjustment of Chinese preschool migrant children: The moderating role of resilience
Jingjing Zhu, Zhenzhen Zhang, Pin Xu, Kaiyu Huang and Yan Li

18 The role of early social play behaviors and language skills for shy children's later internalizing difficulties in school
Silje Baardstu, Stefania Sette, Ragnhild Eek Brandlistuen and Mari Vaage Wang

31 Positive classroom climate buffers against increases in loneliness arising from shyness, rejection sensitivity and emotional reactivity
Gintautas Katulis, Goda Kaniušonytė and Brett Laursen

41 Are you alone? Measuring solitude in childhood, adolescence, and emerging adulthood
Alicia McVarnock, Tiffany Cheng, Laura Polakova and Robert J. Coplan

54 Social avoidance and social adjustment in Chinese preschool migrant children: the moderating role of teacher–child relationships
Jingjing Zhu, Xiaoqi Yin, Xiaoyun Li, Xinyi Dong, Shiyao Zou and Yan Li

67 Moderating effect of classroom sociable norm on the relations between unsociability and internalizing problems in Chinese adolescents
Yihao Hu, Amanda Bullock, Ying Zhou and Junsheng Liu

76 Growth of preference for solitude in urban and rural Chinese adolescents
Xi Chen, Xinxin Sun, Xuan Wu, Junsheng Liu, Dan Li and Xinyin Chen

85 Solitude profiles and psychological adjustment in Chinese late adolescence: a person-centered research
Tong Zhou, Longyue Liao, Thuy-Vy T. Nguyen, Dan Li and Junsheng Liu

95 Comparison of behaviorally inhibited and typically developing children's play behaviors in the preschool classroom
Lindsay R. Druskin, Danielle R. Novick, Kelly A. Smith, Andrea Chronis-Tuscano, Nicholas J. Wagner, Stephanie Pham, Hailey M. Fleece, Christina M. Danko and Kenneth H. Rubin

frontiers | Frontiers in Psychiatry

TYPE Editorial
PUBLISHED 26 January 2024
DOI 10.3389/fpsyt.2024.1366539

OPEN ACCESS

EDITED AND REVIEWED BY
Wulf Rössler,
Charité University Medicine Berlin, Germany

*CORRESPONDENCE
Xi Chen
xchen@psy.ecnu.edu.cn

RECEIVED 06 January 2024
ACCEPTED 19 January 2024
PUBLISHED 26 January 2024

CITATION
Chen X, Liu J, Schmidt LA and Ding X (2024) Editorial: Causes and consequences of solitude in children and adolescents. *Front. Psychiatry* 15:1366539. doi: 10.3389/fpsyt.2024.1366539

Editorial: Causes and consequences of solitude in children and adolescents

Xi Chen[1,2]*, Junsheng Liu[1,3], Louis A. Schmidt[4] and Xuechen Ding[5]

[1]School of Psychology and Cognitive Science, East China Normal University, Shanghai, China, [2]Shanghai Key Laboratory of Mental Health and Psychological Crisis Intervention, Shanghai, China, [3]Shanghai Changning Mental Health Center, Shanghai, China, [4]Department of Psychology, Neuroscience & Behaviour, McMaster University, Hamilton, ON, Canada, [5]School of Psychology, Shanghai Normal University, Shanghai, China

KEYWORDS

solitude, adjustment, children, adolescents, moderator

Editorial on the Research Topic
Causes and consequences of solitude in children and adolescents

Solitude has been conceptualized as *physical* or *perceived* separation from others or a state of *no social interaction* (see McVarnock et al.). Historical perspectives have highlighted both the benefits and costs of solitude for children and adolescents. On the one hand, spending time alone is believed to promote important developmental skills, such as self-regulation and the attainment of autonomy. On the other hand, there is a prevalent concern that excessive time alone will deprive children and adolescents of the valuable and unique opportunities and benefits that come with peer interactions. This paradox illustrates the complex nature of solitude. Nine articles in the Research Topic of "*Causes and Consequences of Solitude in Children and Adolescents*" clarify a broad range of viewpoints and offer substantial empirical evidence to the following themes. The constructs and pathways reviewed or empirically examined in this Research Topic are presented in Figure 1.

Conceptualization, assessment, and implications of the heterogeneous nature of solitude

McVarnock et al. reviewed the operational definition and measurement of solitude in psychological studies of children, adolescents, and emerging adults since the year 2000. The authors identified 19 empirical studies which measured "spending time alone" using three main approaches: experiments, retrospective reports and experience sampling measures. The majority of these studies focused on merging adults, with a few focused on adolescents and only one examining solitude in children. The considerable variation within measurement approaches, including the operational definitions of "solitude" and the outcomes assessed, may impact study findings. Despite the variation, overall solitude was associated with negative outcomes. However, implications of solitude vary depending on

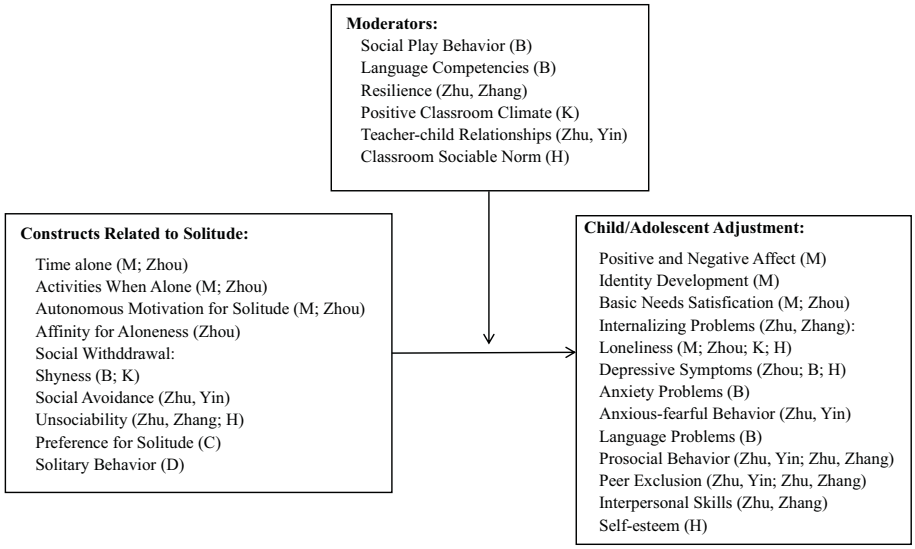


FIGURE 1
Constructs and pathways reviewed or empirically examined in this Research Topic. M, McVarnock et al.; Zhou, Zhou et al.; B, Baardstu et al.; K, Katulis et al.; Zhu, Yin, Zhu et al.; Zhu, Zhang, Zhu et al.; H, Hu et al.; C, Chen et al.; D , Druskin et al..

several factors, including activities engaged while alone, and how voluntarily and for what reasons individuals choose to spend time in solitude.

Zhou et al. identified four groups of Chinese late adolescents using latent profile analysis according to the activities they engaged in when alone, their motivation and attitude for solitude and how much time they spent alone. The four groups were: an absence of aloneness group (21.13%), who spent the least time alone; an positive motivational solitude group (29.01%), who reported the highest autonomous motivation for solitude and highest affinity for aloneness; an negative motivational solitude group (38.03%), who reported the highest aversion to aloneness; and an activity-oriented solitude group, who reported most likely to engage in physical activities when alone. Among the four groups, the negative motivational solitude group reported the highest levels of loneliness and depressive symptoms and the lowest levels of basic needs satisfaction; the absence of aloneness group reported the lowest levels of loneliness; the other two groups fell in between. This study sheds light on the heterogeneous nature of solitude. Echoing McVarnock et al., the findings highlight the importance to consider activities while alone and motivations for solitude when examining implications of solitude for adjustment.

The complex relations between social withdrawal and adjustment in children and adolescents

Social withdrawal, i.e., children choosing to reduce engagement in peer interaction, is one of the major causes of solitude (see McVarnock et al.). There are three types of social withdrawal, characterized by specific combinations of social approach and avoidance motivations: shyness (high approach; high avoidance), social avoidance (low approach; high avoidance) and unsociability (low approach; low avoidance). Overall, social withdrawal is associated with maladjustment, and several articles examined the moderating effects of individual and environmental factors on this association.

Baardstu et al. found that childhood shyness from 18 months to five years old predicted internalizing difficulties and language problems at eight years old. In addition, high levels of language competencies and social play behaviors buffered against later anxiety problems among shy children. Katulis et al. found that shyness, emotional reactivity, and rejection sensitivity in grades 5-7 predicted loneliness 4-5 months later, and these associations were mitigated by positive classroom climate.

Zhu et al. found that higher social avoidance was related to higher peer exclusion and lower prosocial behavior among Chinese migrant preschoolers. In addition, teacher-child relationship moderated these associations. Specifically, the association between social avoidance and peer exclusion was weaker for children with higher teacher-child closeness, whereas the associations between social avoidance and peer exclusion and anxious-fearful behavior were stronger for children with higher teacher-child conflict.

Zhu et al. found that higher unsociability was related with higher peer exclusion and internalizing problems, and related with lower prosocial behaviors and interpersonal skills among Chinese migrant preschoolers. Moreover, these associations were buffered by children's resilience. Hu et al. found that higher unsociability was related with higher depression and loneliness, and related with lower self-esteem among Chinese adolescents in grades 4-8. In addition, these relations were exacerbated in classrooms with high sociable norm.

Changes in solitude motivation from a developmental perspective

During the transition from childhood to adolescence, individuals' preference for solitude (PFS) increases as they grow older. Adolescents need to find a balance between the desire for social connection and the desire for independence. Because these desires are shaped by the social-cultural contexts, the rate at which PFS develops may vary across social-cultural contexts. Chen et al. found that for both urban and rural Chinese adolescent, PFS increased from Grade 6 to Grade 8. Moreover, in accordance with the more salient individualistic values in urban regions, PFS increased faster among urban adolescents than rural adolescents.

Besides the articles mentioned above, Druskin et al. observed preschoolers' in-school social behaviors and found that compared with typically developing children, children with high behavioral inhibition showed more reticent and solitary behavior, and less social play and teacher interaction.

In summary, articles in this Research Topic include diverse samples and cover a wide age range from preschool years to late adolescence. Several articles advance our understanding about heterogeneity of solitude and its development. Findings of the articles, especially those regarding moderators between social withdrawal and children's adjustment, have important practical implications for reducing adverse implications of solitude for child and adolescent development.

Author contributions

XC: Writing – original draft, Writing – review & editing. JL: Writing – review & editing. LS: Writing – review & editing. XD: Writing – review & editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

frontiers | Frontiers in Psychiatry

TYPE Original Research
PUBLISHED 24 January 2023
DOI 10.3389/fpsyt.2023.1074217

OPEN ACCESS

EDITED BY
Junsheng Liu,
East China Normal University, China

REVIEWED BY
Amanda Bullock,
Carleton University, Canada
Xi Chen,
East China Normal University, China

*CORRESPONDENCE
Yan Li
✉ liyan@shnu.edu.cn

SPECIALTY SECTION
This article was submitted to Public Mental Health, a section of the journal Frontiers in Psychiatry

RECEIVED 19 October 2022
ACCEPTED 02 January 2023
PUBLISHED 24 January 2023

CITATION
Zhu J, Zhang Z, Xu P, Huang K and Li Y (2023) Unsociability and social adjustment of Chinese preschool migrant children: The moderating role of resilience.
Front. Psychiatry 14:1074217.
doi: 10.3389/fpsyt.2023.1074217

Unsociability and social adjustment of Chinese preschool migrant children: The moderating role of resilience

Jingjing Zhu[1], Zhenzhen Zhang[1], Pin Xu[2], Kaiyu Huang[3] and Yan Li[1]*

[1]Early Childhood Education College, Shanghai Normal University, Shanghai, China, [2]Hongkou District Education College, Shanghai, China, [3]Qingpu District Education College, Shanghai, China

Objectives: The present study examined the moderating effect of children's resilience on the relations between unsociability and social adjustment (i.e., prosocial behaviors, peer exclusion, interpersonal skills, internalizing problems) in Chinese preschool migrant children.

Methods: Participants were N = 148 children (82 boys, M_{age} = 62.32 months, SD = 6.76) attending two public kindergartens in Shanghai, People's Republic of China. Mothers provided ratings of children's unsociability and resilience; teachers assessed children's social adjustment outcomes, and children reported their receptive vocabulary.

Results: Unsociability was positively associated with peer exclusion and internalizing problems, and negatively associated with prosocial behaviors and interpersonal skills among Chinese preschool migrant children. Moreover, children's resilience significantly moderated the relationship between unsociability and social adjustment. Specifically, among children with lower levels of resilience, unsociability was significantly and positively associated with peer exclusion and internalizing problems, while among children with higher levels of resilience, unsociability was not associated with social adjustment difficulties.

Conclusion: The current findings inform us of the importance of improving children's resilience to buffer the negative adjustment among Chinese migrant unsociable young children. The findings also highlight the importance of considering the meaning and implication of unsociability for preschool migrant children in Chinese culture.

KEYWORDS

preschool migrant children, resilience, unsociability, social adjustment, China

Introduction

In early childhood, peer relationship plays an essential and unique role to children's social, emotional, and cognitive development (1). Children who do not engage in peer interactions (e.g., socially withdrawn children) may miss out on the potential benefits of interactive experiences, peer support, and other benefits that come from such social situations, which cause a host of behavior problems and adjustment difficulties, exposing those children to additional psychological developmental risks and dilemmas (2). Social withdrawal is defined

as the behavior of children who inhibit themselves from participating in peer interactions and exhibit solitary pastimes in social contexts (2, 3). According to the conceptual model proposed by Asendorpf, children's social withdrawal behavior is determined by a combination of social approach motivations (i.e., desire to seek social interactions) and social avoidance motivations (i.e., desire to avoid social interactions), which can be further classified as shyness, unsociability, and social avoidance (4, 5). Unsociability and shyness are based on different levels of internal approach and avoidance motivations in challenging social situations (6). Shyness is characterized by approach-avoidance motivation conflict, in which shy children want to play with their peers but are simultaneously inhibited by fear and anxiety (5). In contrast, unsociability is characterized as reflecting a combination of low social approach motivation and low social avoidance motivation, referring to behaviors in which children are not interested in social activities and do not actively resist the interaction of others (5). However, shyness and unsociability are positively associated with withdrawal behaviors, as well as negatively associated with social initiations and psychological engagement during peer interactions (7). Shyness and unsociability are characterized as related but distinct constructs and, therefore, it has become common practice to control for any shared variance in order to explore their unique effects and implications (7).

Unlike shyness, unsociability has been considered a relatively benign form of social withdrawal, particularly in early childhood, this might be due to the endorsement of preferred solitary behavior in individualistic societies (7, 8). In support of this notion, results from a study among young children suggested that unsociability is not necessarily associated with perceived social and physiological adjustment (i.e., peer problems, internalizing problems, social anxiety) (7). Because collectivistic cultures society such as China places a high emphasis on social interdependence and group affiliation, parents teach children to form a sense of family affiliation and responsibility from an early age (9). In this regard, unsociable children who pursue their preferences rather than stay in groups may be considered anti-collective and selfish, which may cause adverse reactions from others and increase their risk of negative social adjustment (10). For example, results from previous studies showed that unsociability in Chinese adolescents and preschool children was uniquely associated with peer problems (i.e., peer victimization, peer exclusion), internalizing problems (i.e., loneliness, depression), and academic problems (11, 12).

In recent years, with the accelerated development of the economy and urbanization process in China, rural-to-urban migration has gradually become one of the most salient contextual factors shaping Chinese family life in the 21st century (13). According to the "Annual Report on China's Education for Migrant Children (2019–2020)," the number of migrant children under 17 years old in China was 34.26 million, among which the size of preschool migrant children under 5 years old had reached 10.53 million, which is accounting for 30.74% of the total number of migrant children, ranking first among all age groups and the most significant increase (14). Furthermore, compared to school-age migrant children, preschool migrant children face enormous challenges, such as the upbringing setting transition from family to kindergarten, the rapid development period of physics and physiology, as well as the adaptation of increasingly complex external environment, which all have caused certain impacts and challenges to cognitive development and interpersonal interactions (15). Thus, we cannot ignore the social adjustment of preschool migrant children.

To our knowledge, the relations between Chinese children's migrant experience and psychological well-being have been extensive study in the past decade. For example, previous studies indicated that compared with non-migrant children, migrant children are more likely to experience higher prevalence of mental health problems, including depression, social anxiety, and behavior problems (16, 17). Both residential and school mobility represent significant ecological transitions for children, which is a major challenge for the positive adjustment of migrant children. The migrant children's social adjustment is also influenced by the *hukou* system, which allocates residency rights to the birth population, linking their rights and benefits to their *hukou* status and location. Previous evidence revealed that the preservation of the current *hukou* system of household registration might expose urban migrants to unfair maltreatment and make migrants a vulnerable social group (18). Because migrant parents and children do not have legal registration status in the city. As a result, migrant children do not have the same privileges as urban children, which do not have access to the same quality of education in public schools. In such cases, migrant children may not be able to access stable support from the city, which perhaps leads to their social maladjustment. In addition, it has been found that the screen rate for social withdrawal is higher in migrant children than in non-migrant children in China (19). Thus, migrant children may be more likely to exhibit unsociable behavior. Accordingly, in the present study, we sought to examine the relations of unsociability with social adjustment in Chinese migrant children. To our knowledge, the only existing study related to this topic is the one conducted by Ding et al. (20) on relations between unsociability and adjustment in migrant children in China. The researchers found in that study that unsociability is more evidently associated with social adjustment problems in Chinese migrant children than in non-migrant children.

Notwithstanding, not all unsociable children undergo social maladjustment, implying that some potential risk or protective factors may affect adjustment outcomes for withdrawn children in China (21, 22). The previous study has found that some migrant children follow a "disadvantaged—resilient—well-developed" trajectory, resulting in positive physiological adjustment (23). Resilience, as "the process of, capacity for, or outcome of successful adjustment despite challenging or threatening circumstances," is regarded as an important protective factor for emotional and behavior problems of children (24). Accordingly, we would focus on unsociability in the current study, which has drawn noticeably less consideration than shyness among Chinese young children (12). More precisely, we explored the potential moderating role of resilience in relations of unsociability with social adjustment in a sample of preschool migrant children in China.

Unsociability and social adjustment

Cultural contexts play an important role in the development of children's social behavior and adjustment functioning (9). The attitudes of peers, parents and teachers to specific social behaviors vary across cultures, which influence children's social, emotional, and school adjustments (25). In western societies, unsociability does not imply low social skills and is sometimes viewed as an expression of personal choice, autonomy, or self-oriented action (8). Thus, unsociability is considered to be a relatively benign form of social withdrawal. In this regard, previous evidence consistently revealed

that unsociability is not associated with internalizing problems, peer problems, and social anxiety in children from early childhood through early adolescence (7, 26), and peers also report greater acceptance of unsociable children than shy peers (27). However, the Chinese Confucian culture emphasizes children's obedience to the expectations and standards of authoritative parents, but unsociable behavior is notably characterized by solitary action, and unsociable children do not inhibit their willingness to continue to indulge in solitary play because of the needs of the surrounding environment, which is clearly at odds with the demands of a collectivist culture (28). Thus, unsociability is more likely to cause negative outcomes on children's social, psychological, and school adjustment in Chinese society. For example, Liu et al. found that unsociability was associated with adjustment difficulties more strongly in Chinese children than in their Canadian counterparts (29). Furthermore, in a sample of Chinese early adolescents, research evidence suggested that unsociability was associated with peer difficulties, school maladjustment, and internalizing problems (11, 30), even in early childhood (12, 31).

Given that unsociable children experience increased adjustment difficulties, not to mention preschool migrant children in China, it is crucial to identify factors that "protect" or "buffer" against negative outcomes. One area of interest involves the role of resilience, which has been found to alleviate children's internalizing problems, peer problems, and prosocial behaviors (32). Additionally, previous evidence also indicated that higher levels of resilience help reduce social withdrawal behaviors among Chinese left-behind preschool children (33), but the effect on unsociability remains unclear. While previous study has identified the protective influence of resilience on social adjustment among Chinese children, little research examined the resilience in moderating the relations between unsociability and social adjustment, particularly among rural-to-urban migrant preschoolers in China. Therefore, this study would examine the relations between unsociability and social maladjustment and further explore the moderating role of resilience in these relations among Chinese migrant preschoolers.

Resilience: A moderator

Resilience is defined as an individual's flexibility to cope with different difficulties and challenges in life and the ability to recover from adversities and misfortunes (34). Miller found that among students with learning disabilities, compared to non-resilience, those with higher levels of resilience could gain successful experiences, begin to identify areas of strength, and engage in activities with peers (35). This further suggested that when adverse situations or risk factors hinder children's development, children's resilience could serve as a protective factor, stimulating their inherent qualities, reducing the harmful effects of adverse situations on children, and making them more adaptable (36). Moreover, resilience has been considered an essential element in positive psychology, and it has been found to be associated with children's subjective well-being and positive cognitions during childhood (37, 38). For example, children with higher levels of resilience perceive less distress and stress, and are less likely to suffer from anxiety and depression (39). In conclusion, resilience can contribute to positive developmental outcomes for disadvantaged children.

As discussed above, because of the increased risks faced by migrant children, there is a need to identify protective factors that can help them successfully adapt to new environments, and manage the accompanying psychological and adjustment challenges that acculturation encompasses. According to the *protective factor model*, when certain positive internal characteristics are present, individuals will have an immunity to stress, which reduces the negative impact of stress on the individual's adjustment functioning (40). Thus, resilience could act as a positive inner characteristic that reduces or counteracts the negative impact of risk factors on individual development outcomes. Previous studies found that the protective effects of resilience for disadvantaged children (41–43). For example, Martinez-Torteya et al. (41) have found that in early childhood, resilience played a protective role in maintaining positive adaptive and easy temperamental characteristics in children exposed to domestic violence, compared to their non-resilient counterparts (41). Furthermore, previous research suggested that resilient children enable positive adaptation despite maltreatment (44). Sattler and Gershoff also found that children in poverty who reached higher levels of resilience at entry to kindergarten exhibit similar academic achievement throughout elementary school as children not in poverty (45). Similarly, the findings were found in a study sample of Chinese children. For example, Fan and Fan found that higher levels of resilience could reduce the psychological adjustment difficulties (e.g., depression, loneliness, self-esteem) among Chinese left-behind children (42). They identified resilience as a quality necessary for the growth of children in adversity. It has been found that resilience moderated the relationship between peer victimization and depression among migrant school-age children in China (43). Specifically, the negative impact of peer victimization on depressive symptoms decreased with the increased levels of resilience.

In conclusion, most of the existing literature generally points to the positive development of disadvantaged children from a resilience perspective, and little work has yet examined the moderating role of resilience in the relationship between unsociability and social adjustment among unsociable migrant preschoolers in the context of Chinese culture.

The present study

As mentioned above, unsociability is incompatible with the traditional Chinese values of social interdependence and group affiliation (10). As such, unsociability has been found to cause a range of children's adjustment difficulties (12, 31), and it could be inferred that migrant unsociable children would face greater adjustment difficulties. According to the *stress-buffer model* (46, 47), although migrant unsociable children experience double distress of life environment and psychological problems, considering resilience as the potential quality for children could buffer the effects of "migration" and "unsociability," then they would show the positive social adjustment. Indeed, existing studies have indicated that resilience could reduce migrant children's adjustment problems (23, 32, 48). Previous studies have focused on the impact of relative unsociability and social adjustment difficulties among Chinese non-migrant children (12, 31). However, the underlying mechanism of resilience in the relations between unsociability and social adjustment is unclear among Chinese preschool migrant children (20). Furthermore, previous research has found that compared to unsociable girls, unsociable boys would be less accepted by their peers, experience more peer problems, and have poorer quality of friendships (49). Thus, we examined the gender differences in the

subsequent analysis. In addition, children's social communicative competence plays a vital role in children's peer experiences (50). It has been indicated that children's receptive vocabulary is associated with socioemotional adjustment (51). Therefore, it is critical to control for migrant children's receptive vocabulary in the study.

In summary, the primary purpose of the present study was to examine the moderating role of resilience between unsociability and social adjustment among preschool migrant children in China. To be consistent with the previous research (e.g., 11, 12), we focused on four main aspects of social adjustment: prosocial behaviors, peer exclusion, interpersonal skills, and internalizing problems. Based on the extant literature, we expected that unsociability was significantly associated with adjustment difficulties. Furthermore, it was hypothesized that resilience would moderate the relations between unsociability and social adjustment. While at higher levels of resilience, it would serve to buffer unsociable migrant preschoolers from experiencing social maladjustment (see **Figure 1**).

Materials and methods

Participants

Participants were N = 148 preschool migrant children (82 boys, M_{age} = 62.32 months, SD = 6.76) recruited from two public kindergartens in Shanghai, People's Republic of China. All children were of Han ethnicity, which represents over 97% of China's population.

Nearly 22% of the mothers and 24% of the fathers had completed high school; 40% of the mothers and 27% of the fathers had completed junior college; 35% of the mothers and 41% of the fathers had earned a bachelor's degree, and 3% of the mothers and 8% of the fathers had earned a postgraduate degree. Maternal and paternal scores were averaged to create a broader measure of parental education (with higher scores representing higher education).

Procedure

The present study was reviewed and approved by the ethics review board of Shanghai Normal University. Written consent was obtained from parents of all migrant preschoolers. The participation rate was 98%. Mothers rated their children's unsociability and resilience. During children's testing sessions, we assessed children's receptive vocabulary. Teachers completed measures of children's social adjustment.

Measures

Maternal ratings

Mothers completed the Chinese version of Child Social Preference Scale (CSPS) (31, 52). Of particular interest was the subscale assessing *unsociability*, which comprises 4 items (e.g., "My child is just as happy to play quietly by his/herself than to play with a group of children," α = 0.65). Given the common conceptual overlap and similar patterns of adjustment among Chinese youth, it is important to control for any common variation with shyness when exploring the implications of unsociability among Chinese migrant children (29, 52). As such, mothers also completed the *shyness* subscale, which comprises 7 items (e.g., "My child seems to want to play with other children, but is sometimes nervous to," α = 0.86). Items were rated on a five-point scale (from 1 = "not at all" to 5 = "a lot"). These items were aggregated to create the unsociability and shyness score, with higher scores indicating higher levels of unsociability and shyness.

Mothers also completed the Chinese version of Ego-Resiliency Scale (ERS) (53). The ERS scale comprises 11 items (e.g., "Freezes up when things are stressful, or else keeps doing the same thing over and over again"; α = 0.89). Items were rated on a nine-point scale (from 1 = "not at all" to nine = "a lot"), with higher scores indicating higher levels of resilience.

Teacher ratings

Teachers were asked to completed the Chinese version of Child Behavior Scale (CBS) (54, 55). Of particular interest were subscales assessing *prosocial behaviors* (6 items, e.g., "Help other children"; α = 0.90) and *peer exclusion* (7 items, e.g., "Not welcomed by other children"; α = 0.86). Items were rated on a three-point scale (from 1 = "doesn't apply" to 3 = "certainly applies"), with higher scores indicating higher levels of prosocial behaviors and peer exclusion. The CBS has been shown to be reliable and valid in young Chinese children (55).

Teachers also completed the Chinese version of Social Skills Teacher Rating System (SSTRS) (56, 57). We were particularly interested in the subscales assessing *interpersonal skills* (11 items, e.g., "Make friends easily"; α = 0.90) and *internalizing problems* (4 items, e.g., "Looks lonely"; α = 0.66). Items were rated on a three-point scale (from 0 = "never" to 2 = "always"), with higher scores indicating higher levels of interpersonal skills and internalizing problems. The SSTRS has been shown to be reliable and valid in young Chinese children (57).

Children assessments

Children' *receptive vocabulary* was assessed using the Chinese version of the Peabody Pictures Vocabulary Test (PPVT-III) (58). The scale consists of 204-items, for every item include four pictures, a picture was shown on a quadrant, and the child was asked to identify the picture that best fit the word that was read to the child. Testing took place in blocks of eight items. If a child made more than six errors within a single block of eight items, testing was discontinued. The final receptive-vocabulary scores (range from 0 to 204) were computed by subtracting all the incorrect and missed answers from the total number of items (i.e., 204), and with higher scores indicating higher levels of receptive-language skills (59). The PPVT-III has been shown to be reliable and valid in Chinese children (12).

Statistical analysis

We used SPSS 26.0 software for data analysis. Preliminary analyses included a series of t-tests to explore gender differences and correlations among study variables. Next, we used the PROCESS macro (Model 1) with non-parametric bootstrapping with 1,000 resamples to explore moderating effect (60). The significant effects were probed with a 95% bias-corrected confidence interval (CI) (61). Finally, the Johnson-Neyman (J-N) technique was used to probe significant interactions (62), as suggested by other researchers (49).

Results

Preliminary analyses

Descriptive statistics and correlations for all study variables are displayed in Table 1. The results of the *t*-tests indicated that there were significant gender differences in prosocial behaviors (M_{boy} = 2.24, SD = 0.57; M_{girl} = 2.45, SD = 0.52, t = −2.27, p = 0.02), peer exclusion (M_{boy} = 1.23, SD = 0.43; M_{girl} = 1.07, SD = 0.20, t = 2.72, p = 0.007), and interpersonal skills (M_{boy} = 1.36, SD = 0.44; M_{girl} = 1.57, SD = 0.36, t = −3.11, p = 0.002). There were no gender differences in internalizing problems (M_{boy} = 0.23, SD = 0.33; M_{girl} = 0.14, SD = 0.25, t = 1.66, p = 0.10), resilience (M_{boy} = 6.36, SD = 1.02; M_{girl} = 6.62, SD = 1.02, t = −1.55, p = 0.12), and unsociability (M_{boy} = 1.76, SD = 0.57; M_{girl} = 1.67, SD = 0.58, t = 0.93, p = 0.35).

As indicated in Table 1, Unsociability was significantly and positively associated with peer exclusion and internalizing problems (marginal significant), and was significantly and negatively associated with prosocial behaviors and interpersonal skills. Resilience was not significantly associated with indices of social adjustment. Children's age was significantly and positively associated with prosocial behaviors and interpersonal skills. Children's receptive vocabulary was significantly and positively associated with prosocial behaviors and interpersonal skills, and significantly and negatively associated with unsociability, peer exclusion, and internalizing problems. Parental education was significantly and positively associated with resilience. Accordingly, we controlled for child gender, age, receptive vocabulary, parental education, shyness in the subsequently analyses.

Unsociability, resilience, and social adjustment

The primary goal of current study was to examine the moderating effects of resilience in the relations between unsociability and social adjustment among preschool migrant children. To accomplish this goal, we tested the effects of unsociability and resilience (and their interaction) in relation to the outcome variables (i.e., prosocial behaviors, peer exclusion, interpersonal skills,

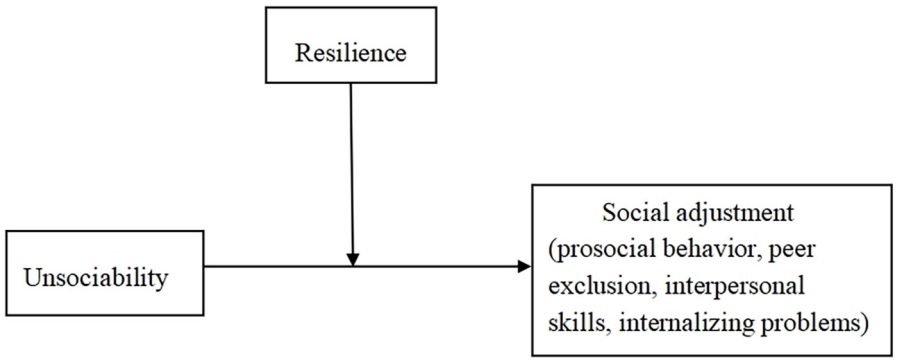


FIGURE 1
The hypotheses model.

TABLE 1 Descriptive statistics and inter-correlations for all study variables (N = 148).

	1	2	3	4	5	6	7	8	9	10	11
1. Gender	–										
2. Age (month)	−0.06	–									
3. Parental education	0.02	0.04	–								
4. Receptive vocabulary	0.10	0.52***	0.11	–							
5. Shyness	0.01	−0.07	0.02	−0.19*	–						
6. Unsociability	−0.08	−0.10	0.07	−0.25**	0.63***	–					
7. Prosocial behavior	0.19*	0.46***	0.10	0.53***	−0.27**	−0.29***	–				
8. Peer exclusion	−0.22**	0.01	0.04	−0.22**	0.20*	0.25**	−0.51***	–			
9. Interpersonal skills	0.25**	0.19*	0.08	0.50**	−0.30***	−0.32***	0.63**	−0.65***	–		
10. Internalizing problems	−0.14	0.10	0.09	−0.19*	0.24**	0.15^{+}	−0.25***	0.35***	−0.42***	–	
11. Resilience	0.13	−0.11	0.36***	0.14	−0.20*	−0.19*	0.03	−0.11	0.16	−0.07	–
M	–	62.32	–	73.02	1.84	1.72	2.34	1.16	1.45	0.19	6.48
SD	–	6.76	–	28.98	0.68	0.57	0.56	0.36	0.42	0.30	1.02

$^{+}p < 0.01$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

internalizing problems), while controlling for children's gender,[1] age, receptive vocabulary, shyness, and parental education. Analyses were conducted using the SPSS macro PROCESS (60). Results are displayed in Table 2. These findings were largely consistent with the correlational analyses (despite the additional control variables). Of particular interest, there were significant interaction effects between unsociability and resilience were also found to be related to peer exclusion and internalizing problems.

Following suggestions by Hayes and Matthes (63), we used the Johnson–Neyman (J-N) technique to further probe the significant interactions (all the predictors were standardized for the analyses) (62). This technique allowed us to estimate a region of significance for the simple slope of a predictor conditioned on the value of the continuous moderator. The results found that for the prediction of peer exclusion and internalizing problems (see Figures 2, 3), when resilience level was lower than −0.46 SD and 1.22 SD, separately, unsociability was significantly and positively associated with peer exclusion and internalizing problems. However, when resilience level was higher than −0.46 SD and 1.22 SD, separately, unsociability was no longer associated with peer exclusion and internalizing problems.

1 There were no significant unsociability × gender interaction effects.

TABLE 2 Main and moderating effects of unsociability and resilience on indices of social adjustment.

	Social adjustment variables					
	B	SE	*t* value	95% CI	R^2	*F*
Prosocial behavior						
Gender	0.33	0.13	2.46*	[0.06, 0.60]		
Child age (month)	0.04	0.01	3.64***	[0.02, 0.07]		
Parental education	0.13	0.09	1.34	[−0.06, 0.31]		
Receptive vocabulary	0.01	0.003	3.52***	[0.004, 0.02]		
Shyness	−0.21	0.12	−1.66	[−0.45, 0.04]		
Unsociability	−0.11	0.09	−1.31	[−0.28, 0.06]		
Resilience	−0.09	0.07	−1.14	[−0.23, 0.06]		
Unsociability × Resilience	0.07	0.06	1.09	[−0.05, 0.20]	0.41	11.90***
Peer exclusion						
Gender	−0.33	0.16	−2.05*	[−0.64, -0.01]		
Child age (month)	0.01	0.01	0.85	[−0.02, 0.04]		
Parental education	0.09	0.11	0.84	[−0.12, 0.31]		
Receptive vocabulary	−0.01	0.003	−1.77	[−0.01, 0.001]		
Shyness	0.10	0.15	0.67	[−0.19, 0.39]		
Unsociability	0.14	0.10	1.36	[−0.06, 0.34]		
Resilience	−0.04	0.09	−0.43	[−0.21, 0.14]		
Unsociability × Resilience	−0.17	0.07	−2.26*	[−0.31, -0.02]	0.17	3.61***
Interpersonal skills						
Gender	0.37	0.14	20.64**	[0.09, 0.65]		
Child age (month)	−0.01	0.01	−0.45	[−0.03, 0.02]		
Parental education	−0.05	0.10	0.49	[−0.15, 0.24]		
Receptive vocabulary	0.01	0.003	4.92***	[0.01, 0.02]		
Shyness	−0.23	0.13	−1.77	[−0.48, 0.03]		
Unsociability	−0.10	0.09	−0.11	[−0.28, 0.08]		
Resilience	0.004	0.08	0.05	[−0.15, 0.16]		
Unsociability × Resilience	0.09	0.06	1.40	[−0.04, 0.22]	0.35	9.52***
Internalizing problems						
Gender	−0.17	0.16	−1.06	[−0.48, 0.15]		
Child age (month)	0.03	0.01	2.21*	[0.003, 0.06]		
Parental education	0.15	0.11	1.33	[−0.07, 0.36]		
Receptive vocabulary	−0.01	0.003	−2.47*	[−0.01, -0.002]		
Shyness	0.31	0.15	2.15*	[0.03, 0.60]		
Unsociability	−0.04	0.10	−0.38	[−0.24, 0.16]		
Resilience	−0.001	0.09	−0.002	[−0.17, 0.17]		
Unsociability × Resilience	−0.18	0.07	−2.94**	[−0.32, -0.04]	0.18	3.93***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Discussion

The goal of the present study was to explore the relations between unsociability and social adjustment and the moderating role of resilience in a sample of preschool migrant children in China. Our results indicated that unsociability was associated with prosocial behaviors, interpersonal skills, peer exclusion, and internalizing problems. Additionally, resilience could be viewed as a protective factor that buffers the negative effects of unsociability on peer exclusion and internalizing problems. To our knowledge, this was the first study revealing the moderate role of resilience in the relations of unsociability with social adjustment, which constitutes significant contribution to our understanding of the mechanism between social behaviors and adjustment in different contexts.

Association between unsociability and social adjustment

Results from the current study suggested that unsociability was significantly and negatively associated with prosocial behaviors and interpersonal skills, and significantly and positively associated with peer exclusion and internalizing problems (marginal significance) among Chinese preschool migrant children. The findings were similar to the results of Liu et al. (11), who reported that unsociability in Chinese non-migrant children and adolescents was significantly related to peer preference, peer victimization, internalizing problems, learning problems, and loneliness (11). Zhu et al. (12) also reported that unsociability was related to peer exclusion, asocial behaviors, and anxious-fearful among Chinese preschool non-migrant children (12). However, as indicated by recent research, among non-migrant preschoolers in urban settings, unsociability was unrelated to interpersonal skills (64). For migrant children, the life changes and stressful events caused by migrating from rural-to-urban areas may expose children to challenges that affect various aspects of their development, such as their family relationships, peer relationships, and social competence. This study also supported the argument that compared with non-migrant unsociable preschoolers, migrant unsociable preschoolers have poor social skills and may suffer more social adjustment difficulties.

Chinese society appears to be in flux. It has been argued that social change has positively impacted the valuation of unsociability, shifting

10.3389/fpsyt.2023.1074217

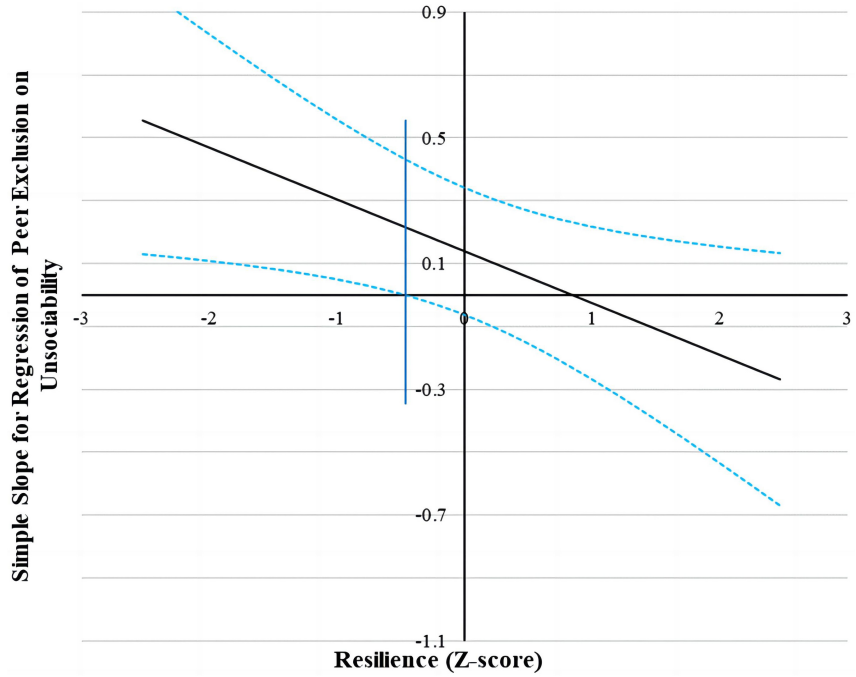


FIGURE 2
Johnson–Neyman regions of significance and confidence bands for mother-rated unsociability along resilience in relation to peer exclusion. Solid diagonal line represents the regression coefficient for unsociability along resilience. Dashed diagonal blue lines are confidence bands–upper and lower bounds of 95% confidence interval for unsociability regression coefficient along resilience. The vertical blue line indicates the point along resilience at which the unsociability regression coefficient transitions from statistical significance (left of dashed vertical line) to non-significance (right of dashed vertical line). The value of the dashed vertical line is −0.46.

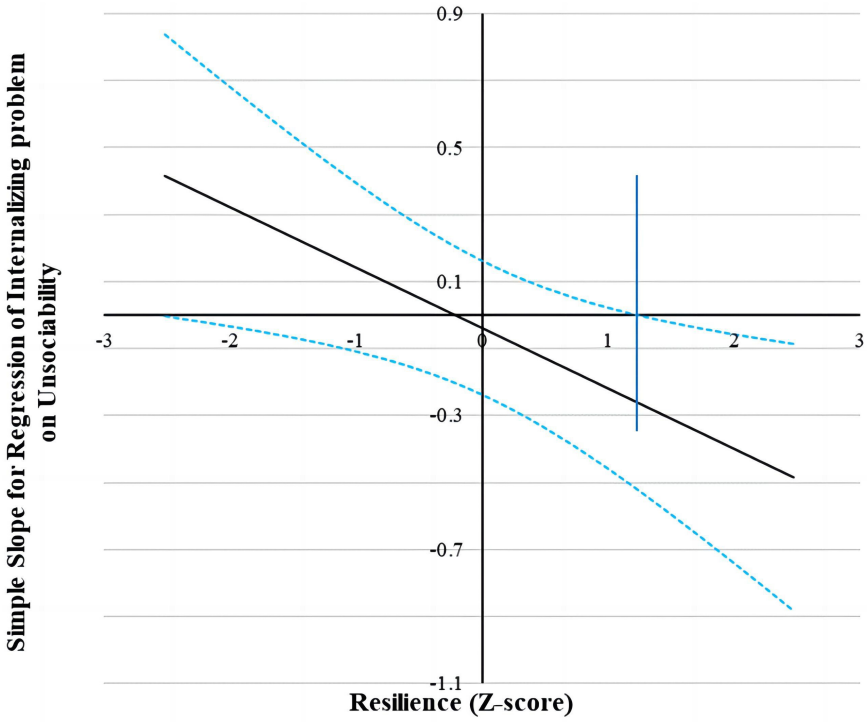


FIGURE 3
Johnson–Neyman regions of significance and confidence bands for mother-rated unsociability along resilience in relation to internalizing problems. Solid diagonal line represents the regression coefficient for unsociability along resilience. Dashed diagonal blue lines are confidence bands–upper and lower bounds of 95% confidence interval for unsociability regression coefficient along resilience. The vertical blue line indicates the point along resilience at which the unsociability regression coefficient transitions from non-significance (left of dashed vertical line) to statistical significance (right of dashed vertical line). The value of the dashed vertical line is 1.22.

attitudes closer to Western society's prevalent view (28). However, Chinese culture emphasizes interdependence and maintaining group harmonization (3). The solitary, non-interacting behaviors have been perceived as undesirable for social regulation and valuation, contrary to the goal of social integration. Therefore, unsociable children are more likely to be negatively evaluated by peers, parents, and teachers, which affects children's social, emotional, and school adjustment (10). In particular, previous evidence revealed that traditional Chinese values may be maintained to a greater extent in families and children with a rural background in China (20). Accordingly, the conflicts between social change and cultural traditions constitutes a more undesirable environment for unsociable children in social adjustment. Overall, unsociability was associated with social adjustment problems in migrant unsociable children in the present study. The results suggested that migrant unsociable preschoolers in urban settings are more likely to experience adjustment difficulties.

Moderating effect of resilience

To be consistent with our hypothesis, this study further verified the moderating role of resilience. After controlling for gender, age, receptive language, parental education, and shyness, the results indicated that resilience moderated the association between unsociability and peer exclusion and internalizing problems in Chinese migrant preschool children. Specifically, unsociability had a significant negative predictive effect on peer exclusion and internalizing problems when children reported lower levels of resilience. However, that unsociability had a non-significant predictive effect on peer exclusion and internalizing problems when migrant children reported higher levels of resilience.

Such results support the *protective factor model* of resilience, which suggests that resilience serves as an individual protective characteristic that could buffer the deleterious effects of personal and/or contextual factors (40). In this regard, resilience, which refers to the capacity of individuals to sustain competent functioning or cope successfully with significant change, adversity, or risk may play a vital role in helping unsociable migrant preschoolers to reduce their risk of social maladjustment (34, 43). Accordingly, Michele et al. also found that children with higher levels of resilience displayed more positive emotions, which plays an important role in the individual's ability to cope with stress (65). Previous evidence revealed that socially avoidant preschoolers with higher levels of emotion regulation would experience fewer internalizing problems (66). Zhao et al. also found that higher levels of resilience mitigated the negative effect of less social support on migrant children's depression and loneliness (23). Thus, Chinese migrant preschoolers with higher levels of resilience may exhibit fewer internalizing problems. Due to their status as "newcomers" in the urban setting (e.g., school, neighborhood), migrant preschoolers are often discriminated against because they are regarded to have undesirable characteristics (e.g., unfamiliar customs, undesirable behaviors) that mark them as different and then lead them to be rejected, victimized, or excluded by peers (67). Of note, children with higher levels of resilience are more curious, enjoy exploring, and exhibit stronger creativity in playing, which can be accepted and appreciated by peers (54). Previous evidence also indicated that higher levels of resilience could buffer the negative effects of peer victimization among rural-to-urban migrant school-age children in China (43). Consequently, Chinese migrant preschoolers with higher levels of resilience may be less excluded by peers.

Moreover, social integration is one of the disadvantages faced by preschool migrant children in the process of "migration," which makes the screen rate of social withdrawal of migrant children higher than non-migrant children (19). Thus, migrant children may be more affected by unsociable behavior. Previous study suggested that unsociability was associated with school and psychological problems more evidently in migrant children than non-migrant children (20). According to the *stress-buffer model* (46, 47), higher levels of resilience may be a protective factor that buffers against the negative impact of "migration" and "unsociability" on social adjustment among migrant preschool children. The previous evidence also revealed that resilience could be a critical "shield" for migrant children, reducing the adverse effect of peer discrimination and improving their social adjustment (48). Accordingly, findings from the present study suggested we should highlight the positive effect of resilience on social adjustment among unsociable migrant preschoolers in China.

Unexpected but interesting, results were that resilience non-significantly moderated the relations of unsociability with prosocial behaviors and interpersonal skills in Chinese preschool migrant children. Unsociability denotes non-fearful preference for solitude and less interest in initiating peer interactions in childhood (5). Previous studies revealed that preschoolers are also more self-focused and ego-centric, and may not pay as much attention to peers (68, 69). In this regard, unsociable children inherently exhibit less prosocial behaviors and poor interpersonal skills, and are more likely to be negatively evaluated by parents and teachers. Moreover, migrant preschoolers constantly face unfamiliar and challenging settings (15), and there may be some other factors related to prosocial behaviors and interpersonal skills. For example, for migrant preschoolers, the parent-child interactions were characterized as lower frequency, and less interactions time, resulting in lower levels of parent-child closeness and mothers responding to children's needs in negative and insensitive ways (70). In this case, migrant children could not learn positive interpersonal skills and exhibit less prosocial behaviors (71). Thus, the moderating role of resilience in the relations between unsociability and prosocial behaviors and interpersonal skills may not be demonstrated in migrant preschoolers.

To summarize, for children with higher levels of resilience, the influence of unsociability on social adjustment was more non-significant. For this result, we can suggest that parents, educators, and others are concerned about migrant children's unsociable behavior. The resilience of migrant children also needs to be developed when providing appropriate interventions to improve the children's social adjustment.

Limitations and future direction

This study makes a novel contribution to the extant literature by providing initial evidence to suggest unsociability associated with a unique pattern of social adjustment difficulties in Chinese preschool migrant children, in which resilience was found to be particularly protective about these relations. Thus, the present study provided valuable information about the role of context in preschool migrant children's social adjustment, and has implications for prevention and intervention. The findings from this research concerning the relations of unsociability with social adjustment in

preschool migrant children suggested that certain vulnerabilities associated with migrant status may indicate appropriate targets for prevention and intervention. For example, parents and professionals should pay particular attention to social adjustment difficulties (e.g., internalizing problems, peer exclusion, poor interpersonal skills, less prosocial behaviors) of migrant unsociable children in various domains (e.g., family, school). Teachers should also help migrant unsociable children to actively engage in social interaction in the kindergarten to reduce their adjustment difficulties. In addition, this study found that resilience could be particularly protective factor in reducing social adjustment problems (i.e., internalizing problems, peer exclusion) of unsociable preschool migrant children. Further research will be critical to the development of specialized prevention and invention programs to improve resilience to reduce internalizing problems and peer exclusion, with practical strategies that are effective for preschool migrant children.

Notwithstanding, some caveats should be considered in interpreting the results, with an eye toward future directions. First, this study only examined preschool migrant children in one of the most developed cities in China (i.e., Shanghai), which is substantial regional differences in social and economic development. Therefore, whether the study results are generalizable remains to be proven. Thus, we can conduct research in other cities with different economic and cultural backgrounds in the future. Second, as the preschoolers can have difficulties reporting their motivations and cognitions (72), mother provided ratings of unsociability as well as assessment of resilience of migrant preschoolers. Mothers' reports can, to some extent, avoid the subjectivity of children's self-reports and thus assess children's social preferences relatively objectively (31). Future research should continue to seek to demonstrate associations between mother-rated unsociability and relevant constructs assessed *via* other means, including direct observation and children's self-reports. Third, this study was a cross-sectional survey, significantly limiting our ability to make causal inference and to establish the direction of effects. In addition, we only examined the development of unsociability, social adjustment, and resilience in current preschool migrant children, which is far from sufficient. In future, a long-term survey is needed to explore the developmental mechanisms in preschool migrant children. Although more difficult to operationalize, future research is worthwhile to fill this gap.

Conclusion

This study focuses on the relations between unsociability and social adjustment (i.e., prosocial behaviors, peer exclusion, internalizing problems, interpersonal skills), and the moderating effect of resilience in preschool migrant children in China. The results indicated that unsociability is positively associated with social adjustment difficulties. In addition, consistent with the hypothesis, resilience moderated the relations of unsociability with peer exclusion and internalizing problems among Chinese migrant preschoolers. Specifically, the relations between unsociability and peer exclusion and internalizing problems were more negative among children with lower levels of resilience, but not significant for children with higher levels of resilience. Therefore, this study suggested that unsociable children with higher levels of resilience could mitigate their social adjustment difficulties. The results provided some implications for exploring the occurrence, development, and intervention of unsociability in disadvantaged migrant preschoolers. For migrant unsociable children who are more willing to be alone and seek less outside support, perhaps helping them improve resilience could be considered by parents and educators.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Shanghai Normal University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

JZ and ZZ managed the literature search and analyses. PX and KH participated in data collection. YL designed the study. All authors contributed to the article and approved the final manuscript.

Funding

This work was supported by funding from the National Social Science Fund of China (21CSH048).

Acknowledgments

We are really grateful to the participating children, parents, and teachers.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

1. Rubin K, Bukowski W, Bowker J. Children in peer groups. In: Lerner RM, Bornstein MH, Leventhal T editors. *Handbook of child psychology and developmental science: ecological settings and processes in developmental systems*. 7th ed. New York, NY: Wiley Blackwell Press (2015). p. 175–222.

2. Rubin K, Coplan R, Bowker J. Social withdrawal in childhood. *Annu Rev Psychol.* (2009) 60:141–71. doi: 10.1146/annurev.psych.60.110707.163642

3. Ding X, Zhou T, Zhang RZ, Zhou N. Social avoidance in childhood: predictors, measurements, and adjustment functioning. *J Psychol Sci.* (2019) 42:604–11. doi: 10.16719/j.cnki.1671-6981.20190314

4. Asendorpf J. Beyond social withdrawal: shyness, unsociability, and peer avoidance. *Hum Dev.* (1990) 33:250–9. doi: 10.1159/000276522

5. Coplan RJ, Armer M. A "multitude" of solitude: a closer look at social withdrawal and nonsocial play in early childhood. *Child Dev Perspect.* (2007) 1:26–32. doi: 10.1111/j.1750-8606.2007.00006.x

6. Coplan R, Ooi L, Nocita G. When one is company and two is a crowd: why some children prefer solitude. *Child Dev Perspect.* (2015) 9:133–7. doi: 10.1111/cdep.12131

7. Coplan R, Ooi L, Xiao B, Rose-Krasnor L. Assessment and implications of social withdrawal in early childhood: a first look at social avoidance. *Soc Dev.* (2018) 27:125–39. doi: 10.1111/sode.12258

8. Coplan R, Ooi L, Baldwin D. Does it matter when we want to be alone? Exploring developmental timing effects in the implications of unsociability. *New Ideas Psychol.* (2019) 53:47–57. doi: 10.1016/j.newideapsych.2018.01.001

9. Chen X, French D. Children's social competence in cultural context. *Annu Rev Psychol.* (2008) 59:591–616. doi: 10.1146/annurev.psych.59.103006.093606

10. Chen X, Wang L, Cao R. Shyness-sensitivity and unsociability in rural Chinese children: relations with social, school, and psychological adjustment. *Child Dev.* (2011) 82:1531–43. doi: 10.1111/j.1467-8624.2011.01616.x

11. Liu J, Chen X, Zhou Y, Li D, Fu R, Coplan R. Relations of shyness–sensitivity and unsociability with adjustment in middle childhood and early adolescence in suburban Chinese children. *Int J Behav Dev.* (2017) 41:681–7. doi: 10.1177/0165025416664195

12. Zhu J, Ooi L, Wu M, Li Y, Coplan R, Cao Y. Exploring the links between unsociability, parenting behaviors, and socio-emotional functioning in young children in suburban China. *Early Educ Dev.* (2021) 32:963–80. doi: 10.1080/10409289.2020.1821538

13. Wang L, Mesman J. Child development in the face of rural-to-urban migration in China: a meta-analytic review. *Perspect Psychol Sci.* (2015) 10:813–31. doi: 10.1177/1745691615600145

14. Han J, Zhu L, Liu Y. *Annual report on China's education for migrant children (2019-2020)*. Beijing: Social Sciences Academic Press (2020).

15. Huang H, Wang X. The effect of family socioeconomic status on migrant preschool children's problem behaviors: the chain mediating role of family resilience and child-parent relationship. *J Psychol Sci.* (2022) 45:315–22. doi: 10.16719/j.cnki.1671-6981.20220207

16. Li X, Zou H, Wang R, Dou D. The developmental characteristics of temporary migrant children's self-esteem and its relation to learning behavior and teacher-student relationship in Beijing. *J Psychol Sci.* (2008) 31:909–13. doi: 10.16719/j.cnki.1671-6981.2008.04.025

17. Lin X, Fang X, Liu Y, Lan J. The effect mechanism of stigma perception on mental health among migrant children in Beijing. *Acta Psychol Sin.* (2009) 41:967–79. doi: 10.3724/SP.J.1041.2009.00967

18. Kuang L, Liu L. Discrimination against rural-to-urban migrants: the role of the hukou system in China. *PLoS One.* (2012) 7:e46932. doi: 10.1371/journal.pone.0046932

19. Zhang L, Zhang J, Luan J, Yang Y. Behavior problem characteristics of migrant children in Baiyun district of Guangzhou. *Chin Gen Pract.* (2012) 15:2950–2. doi: 10.3969/j.issn.1007-9572.2012.09.029

20. Ding X, Chen X, Fu R, Li D, Liu J. Relations of shyness and unsociability with adjustment in migrant and non-migrant children in urban China. *J Abnorm Child Psychol.* (2020) 48:289–300. doi: 10.1007/s10802-019-00583-w

21. Bullock A, Xiao B, Liu J, Coplan R, Chen X. Shyness, parent–child relationships, and peer difficulties during the middle school transition. *J Child Fam Stud.* (2022) 31:86–98. doi: 10.1007/s10826-021-01979-3

22. Zhu J, Fu R, Li Y, Wu M, Yang T. Shyness and adjustment in early childhood in Southeast China: the moderating role of conflict resolution skills. *Front Psychol.* (2021) 12:644652. doi: 10.3389/fpsyg.2021.644652

23. Zhao Y, Zhang X, Du J, Zheng X. Relationship between social support and depression, loneliness of migrant children: resilience as a moderator and mediator. *Chin J Clin Psychol.* (2014) 22:512–21. doi: 10.16128/j.cnki.1005-3611.2014.03.077

24. Masten A, Best K, Garmezy N. Resilience and development: contributions from the study of children who overcome adversity. *Dev Psychopathol.* (1990) 2:425–44. doi: 10.1017/S0954579400005812

25. Chen X. Shyness-inhibition in childhood and adolescence: a cross-cultural perspective. In: Rubin KH, Coplan RJ editors. *The development of shyness and social withdrawal*. New York, NY: Guilford Press (2010). p. 213–35.

26. Sette S, Zava F, Baumgartner E, Laghi F, Coplan R. Examining links between social withdrawal subtypes and internalizing problems among Italian primary school children. *Eur J Dev Psychol.* (2022) 1–19. doi: 10.1080/17405629.2022.2086118

27. Wood K, Coplan R, Hipson W, Bowker J. Normative beliefs about social withdrawal in adolescence. *J Res Adolesc.* (2022) 32:372–81. doi: 10.1111/jora.12617

28. Ding X, Zhang T, Deng X, Sang B, Fang L, Chen C. "Alone but not lonely" or "Alone and also lonely": cultural differences on relations between unsociability and adjustment functioning. *Adv Psychol Sci.* (2015) 23:439–47. doi: 10.3724/SP.J.1042.2015.00439

29. Liu J, Chen X, Coplan R, Ding X, Zarbatany L, Ellis W. Shyness and unsociability and their relations with adjustment in Chinese and Canadian children. *J Cross Cult Psychol.* (2015) 46:371–86. doi: 10.1177/0022022114567537

30. Sang B, Ding X, Coplan R, Liu J, Pan T, Feng X. Assessment and implications of social avoidance in Chinese early adolescents. *J Early Adolesc.* (2018) 38:554–73. doi: 10.1177/0272431616678988

31. Li Y, Zhu J, Coplan R, Gao Z, Xu P, Li L, et al. Assessment and implications of social withdrawal subtypes in young Chinese children: the Chinese version of the child social preference scale. *J Genet Psychol.* (2016) 177:97–101. doi: 10.1080/00221325.2016.1174100

32. Sun S, Guan Y, Qin Y, Zhang L, Fan F. Social support and emotional-behavioral problems: resilience as a mediator and moderator. *Chin J Clin Psychol.* (2013) 21:114–8. doi: 10.16128/j.cnki.1005-3611.2013.01.025

33. Qi Y, Yang N. The effect of self-concept on the left-behind preschool children's social withdrawal behavior: mediating and moderating role of resilience. *Stud Early Child Educ.* (2020) 2:41–56. doi: 10.13861/j.cnki.sece.2020.02.004

34. Dent R, Cameron R. Developing resilience in children who are in public care: the educational psychology perspective. *Educ Psychol Pract.* (2003) 19:3–19. doi: 10.1080/0266736032000061170

35. Miller M. Resilience elements in students with learning disabilities. *J Clin Psychol.* (2002) 58:291–8. doi: 10.1002/jclp.10018

36. Alvord M, Grados J. Enhancing resilience in children: a proactive approach. *Prof Psychol Res Pract.* (2005) 36:238–45. doi: 10.1037/0735-7028.36.3.238

37. Fredrickson B. The broaden-and-build theory of positive emotions. In: Huppert FA, Baylis N, Keverne B editors. *The science of well-being*. Oxford: Oxford University Press (2005). p. 217238. doi: 10.1093/acprof:oso/9780198567523.003.0008

38. Mak W, Ng I, Wong C. Resilience: enhancing well-being through the positive cognitive triad. *J Couns Psychol.* (2011) 58:610–7. doi: 10.1037/a0025195

39. Zhang G, Wang J, Liang Z, Deng H. The relation between adolescents' resilience and school adaptation. *Psychol Dev Educ.* (2017) 33:11–20. doi: 10.16187/j.cnki.issn1001-4918.2017.01.02

40. Garmezy N, Masten A, Tellegen A. The study of stress and competence in children: a building block for developmental psychopathology. *Child Dev.* (1984) 55:97–111. doi: 10.2307/1129837

41. Martinez-Torteya C, Bogat G, von Eye A, Levendosky A. Resilience among children exposed to domestic violence: the role of risk and protective factors. *Child Dev.* (2009) 80:562–77. doi: 10.1111/j.1467-8624.2009.01279.x

42. Fan Z, Fan X. Effect of social support on the psychological adjustment of Chinese left-behind rural children: a moderated mediation model. *Front Psychol.* (2021) 11:604397. doi: 10.3389/fpsyg.2020.604397

43. Ye Z, Chen L, Harrison S, Guo H, Li X, Lin D. Peer victimization and depressive symptoms among rural-to-urban migrant children in China: the protective role of resilience. *Front Psychol.* (2016) 7:1542. doi: 10.3389/fpsyg.2016.01542

44. Yoon S, Helsabeck N, Wang X, Logan J, Pei F, Hamby S, et al. Profiles of resilience among children exposed to non-maltreatment adverse childhood experiences. *Int J Environ Res Public Health.* (2021) 18:10600. doi: 10.3390/ijerph182010600

45. Sattler K, Gershoff E. Thresholds of resilience and within- and cross-domain academic achievement among children in poverty. *Early Child Res Q.* (2019) 46:87–96. doi: 10.1016/j.ecresq.2018.04.003

46. Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. *Psychol Bull.* (1985) 98:310–57. doi: 10.1037/0033-2909.98.2.310

47. Masten A, Wright M. Cumulative risk and protection models of child maltreatment. *J Aggress Maltreat Trauma.* (1998) 2:7–30. doi: 10.1300/J146v02n01_02

48. Zhu Q, Guo H, Pan J, Lin D. Perceived discrimination and problem behaviors among rural-to-urban migrant children: the moderating role of resilience. *Chin J Clin Psychol.* (2015) 23:529–33. doi: 10.16128/j.cnki.1005-3611.2015.03.032

49. Bullock A, Liu J, Cheah C, Coplan R, Chen X, Li D. The role of adolescents' perceived parental psychological control in the links between shyness and socio-emotional adjustment among youth. *J Adolesc.* (2018) 68:117–26. doi: 10.1016/j.adolescence.2018.07.007

50. Kaczmarek L. Assessment of social-communicative competence: an interdisciplinary model. In: Goldstein H, Kaczmarek LA, English KM editors. *Promoting social communication: children with developmental disabilities from birth to adolescence*. Baltimore, MD: Paul H. Brookes (2002). p. 55–115.

51. Zhu J, Li Y, Wood K, Coplan R, Chen X. Shyness and socioemotional functioning in young Chinese children: the moderating role of receptive vocabulary. *Early Educ Dev.* (2019) 30:590–7. doi: 10.1080/10409289.2019.1572481

52. Coplan R, Prakash K, O'Neil K, Armer M. Do you" want" to play? Distinguishing between conflicted shyness and social disinterest in early childhood. *Dev Psychol.* (2004) 40:244–58. doi: 10.1037/0012-1649.40.2.244

53. Eisenberg N, Chang L, Ma Y, Huang X. Relations of parenting style to Chinese children's effortful control, ego resilience, and maladjustment. *Dev Psychopathol.* (2009) 21:455–77. doi: 10.1017/S0954579409000250X

54. Ladd G, Profilet S. The child behavior scale: a teacher-report measure of young children's aggressive, withdrawn, and prosocial behaviors. *Dev Psychol.* (1996) 32:1008–24. doi: 10.1037/0012-1649.32.6.1008

55. Zhu J, Wang Y, Li Y. Reliability and validity of the child behavior scale in Chinese preschoolers. *Chin J Clin Psychol.* (2018) 26:910–3. doi: 10.16128/j.cnki.1005-3611.2018.05.016

56. Gresham F, Elliott S. *Social skills rating system*. Circle Pines, MN: American Guidance Service (1990).

57. Zhu J, Li Y, Zhang Y, Xie Q, Xu P. Reliability and validity of the child social skills rating scale to Chinese preschoolers. *Chin J Clin Psychol.* (2017) 25:855–8. doi: 10.16128/j.cnki.1005-3611.2017.05.014

58. Dunn L, Dunn L. *PPVT-III: peabody picture vocabulary test*. Circle Pines, MN: American Guidance Service (1997).

59. Blankson A, O'Brien M, Leerkes E, Marcovitch S, Calkins S. Shyness and vocabulary: the roles of executive functioning and home environmental stimulation. *Merrill Palmer Q.* (2011) 57:105–28. doi: 10.1353/mpq.2011.0007

60. Hayes A. *PROCESS: a Versatile Computational Tool for Observed Variable Mediation, Moderation, and Conditional Process Modeling.* (2012). Available online at: http://www.afhayes.com/public/process2012.pdf

61. Preacher K, Hayes A. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav Res Methods.* (2008) 40:879–91. doi: 10.3758/BRM.40.3.879

62. Johnson P, Fay L. The Johnson-Neyman technique, its theory and application. *Psychometrika.* (1950) 15:349–67. doi: 10.1007/BF02288864

63. Hayes A, Matthes J. Computational procedures for probing interactions in OLS and logistic regression: SPSS and SAS implementations. *Behav Res Methods.* (2009) 41:924–36. doi: 10.3758/BRM.41.3.924

64. Xie Q, Wang Y, Hu F, Liu X, Li Y. Inhibitory control and social skills in 4 years old children: the moderation role of social withdrawal. *Chin J Clin Psychol.* (2020) 28:1033–7. doi: 10.16128/j.cnki.1005-3611.2020.05.036

65. Michele M, Barbara L, Lisa F. Psychological resilience and positive emotional granularity: examining the benefits of positive emotions on coping and health. *J Pers.* (2004) 72:1161–90. doi: 10.1111/j.1467-6494.2004.00294.x

66. Zhu J, Xiao B, Hipson W, Yan C, Coplan R, Li Y. Social avoidance and social adjustment: the moderating role of emotion regulation and emotion lability/negativity among Chinese preschool children. *Front Psychol.* (2021) 12:618670. doi: 10.3389/fpsyg.2021.618670

67. Chen L, Su S, Li X, Tam C, Lin D. Perceived discrimination, schooling arrangements and psychological adjustments of rural-to-urban migrant children in Beijing, China. *Health Psychol Behav Med.* (2014) 2:713–22. doi: 10.1080/21642850.2014.919865

68. Lee H, Cranford J. Does resilience moderate the associations between parental problem drinking and adolescents' internalizing and externalizing behaviors? A study of Korean adolescents. *Drug Alcohol Depend.* (2008) 96:213–21. doi: 10.1016/j.drugalcdep.2008.03.007

69. Piaget J. *Play, dreams, and imitation in childhood*. New York, NY: Norton (1962).

70. Chen L, Liu Y. The characteristics of migrant children's communication with their parents and its relationship with migrant children's mental health. *Chin J Spec Educ.* (2012) 58–63.

71. Li Y, Xu L, Lu Y, Liu L, Wang Y. The associations between mother-child relationship, teacher-child relationship and social adaptive behaviors for preschool migrant children. *Psychol Dev Educ.* (2014) 30:624–34. doi: 10.16187/j.cnki.issn1001-4918.2014.06.009

72. Thompson R, Goodvin R, Meyer S. Social development: psychological understanding, self-understanding, & relationships. In: Luby JL editor. *Handbook of preschool mental health: development, disorders, and treatment*. New York, NY: Guilford (2006). p. 3–22.

frontiers | Frontiers in Psychiatry

TYPE Original Research
PUBLISHED 01 March 2023
DOI 10.3389/fpsyt.2023.1120109

OPEN ACCESS

EDITED BY
Louis A. Schmidt,
McMaster University, Canada

REVIEWED BY
Keren Hanetz-Gamliel,
The Academic College of Tel Aviv-Yaffo, Israel
Daphna G. Dollberg,
The Academic College of Tel Aviv-Yaffo, Israel

*CORRESPONDENCE
Silje Baardstu
✉ siljekvam.bardstu@fhi.no

SPECIALTY SECTION
This article was submitted to Public Mental Health, a section of the journal Frontiers in Psychiatry

RECEIVED 09 December 2022
ACCEPTED 13 February 2023
PUBLISHED 01 March 2023

CITATION
Baardstu S, Sette S, Brandlistuen RE and Wang MV (2023) The role of early social play behaviors and language skills for shy children's later internalizing difficulties in school. *Front. Psychiatry* 14:1120109. doi: 10.3389/fpsyt.2023.1120109

The role of early social play behaviors and language skills for shy children's later internalizing difficulties in school

Silje Baardstu[1]*, Stefania Sette[2], Ragnhild Eek Brandlistuen[3] and Mari Vaage Wang[3]

[1]Department of Childhood and Families, Norwegian Institute of Public Health, Oslo, Norway, [2]Department of Developmental and Social Psychology, Sapienza University, Rome, Italy, [3]Department of Child Health and Development, Norwegian Institute of Public Health, Oslo, Norway

Research has demonstrated links from early childhood shyness to socioemotional problems later in life. This longitudinal study explored the role of early social play behaviors and language skills in the associations between childhood shyness and later internalizing and language difficulties in school. Participants were *N* = 7,447 children (50.1% girls) from the Norwegian Mother, Father, and Child Cohort Study (MoBa). Latent direct, indirect, and interaction path analyses were performed within a structural equation framework. Results showed that mother-rated childhood shyness from age 18 months to age five years was associated with mother-rated internalizing difficulties and language problems at age eight years. Lower levels of teacher-reported social play behaviors and poorer language skills in preschool increased the risk of later anxiety problems among shy children, whereas higher levels of language competencies and social play behaviors buffered against later anxiety problems. The study identifies some of the early risk and protective factors that may influence shy children's socio-emotional functioning and adjustment.

KEYWORDS

MoBa, shyness, adjustment, longitudinal, risk and protective factors, anxiety, depression, language

1. Introduction

Shyness is a temperament trait that is characterized by wariness, self-consciousness, and reticence in the face of social novelty and/or situations of perceived social evaluation (1). An extensive body of studies have demonstrated how early shyness confer increased risk for both concurrent and prospective difficulties in several developmental domains, and particularly in the areas of socio-communicative skills and socioemotional adjustment (2, 3). However, there is growing recognition for the notion that there is heterogeneity in these observed outcomes [i.e., (4–7)]. In other words, not all shy children are destined to experience or develop such difficulties. This notion elucidates the importance of identifying early risk and protective factors that may influence shy children's developmental course, as this would allow for greater precision in understanding individual differences in the adjustment and functioning of shy children.

Several factors that may influence shy children's adjustment have been suggested in the past decades, including the role of *biological* factors, such as cortisol levels, *individual* factors, such as regulatory functions [i.e., attention bias and inhibitory control; (8–12)], and *environmental* factors, such as parental socialization practices and the quality of relationships with peers and others [for an overview, see (13)]. Some studies have also demonstrated the protective (i.e., moderating) role of language skills and social competencies for shy children's social and emotional functioning (2, 14–17).

However, most of this research has mainly been cross-sectional and using small samples of relatively young children (i.e., toddlers, preschoolers). For this reason, there is a need for more longitudinal studies that may expand our knowledge about the long-term nature of associations between shyness, social behaviors, language skills, and internalizing difficulties from early childhood and into school age, including indirect pathways as well as moderating processes. Thus, using longitudinal data from more than 7,000 children followed from 18 months to age 11 years, the purpose of the present study was twofold: the first aim was to examine the long-term prospective links between early childhood shyness and later internalizing and language problems in school, and the second aim was to explore the mediating and/or moderating role of children's early social play behaviors and language competencies, as reported by early childhood and education care (ECEC) teachers, in these links.

Temperamental shyness overlaps conceptually with other related constructs, such as anxious solitude, behavioral inhibition, and social reticence. For instance, all these constructs share an underlying core related to social fear, anxiety, and wariness, and they also display relatively similar patterns of associations with adjustment difficulties [see (13), for an overview]. In this study, we conceptualize shyness as a temperament trait that is characterized by wariness, anxiety, and discomfort in response to social novelty and/or self-consciousness in situations of perceived social evaluation (1, 18). This discomfort mainly derives from the interpersonal nature of situations and often elicits inhibited and awkward behaviors, including a desire to withdraw from social interactions (19).

Over the past decades, much research has uncovered the behavioral and psychosocial correlates of temperamental shyness in childhood [for a review, see Rubin et al. (20)]. On a behavioral level, shyness may manifest as avoidant, withdrawn, awkward, and inhibited behaviors (e.g., freezing behaviors, watching other children playing but not joining in) during interactions with peers or in unfamiliar social situations (21, 22). Psychosocially, shy children tend to experience lower self-esteem, are perceived to have lower social competence, and have higher anxiety levels compared to non-shy children (1, 23).

Many shy children may also experience an approach-avoidance conflict in which their desire for social interaction (i.e., social approach) is simultaneously inhibited by social fear and anxiety (i.e., social avoidance) (19, 24). This motivational conflict could perhaps explain why shy children often talk less and are less likely to initiate and participate in social interactions with peers compared to more outgoing children (2). Consequently, there is a concern that shy children may have fewer opportunities to practice and develop social and communicative skills and competencies, and that they may also develop feelings of low self-worth and poor self-esteem if they often experience failure in their social engagement with peers (25, 26). In this sense, there is a general conception that shyness is associated with increased risk for poor socio-emotional functioning, including peer problems and loneliness, which, in turn, may increase their risk for emotional difficulties, such as social anxiety and depression [e.g., (27, 28)].

A growing literature has underlined that shyness is concurrently related to emotional difficulties, such as social anxiety and depression, throughout development [i.e., (29, 30)]. Longitudinal studies have also confirmed such links. For instance, Poole et al. (31), across three laboratory visits in early-to-middle childhood, found two trajectories of shyness, including a high-stable class and a low-stable class. Results revealed that teachers and parents perceived children in high-stable classes as more socially anxious than children in the low-stable class. Gender differences were also found in the high-stable class, with boys displaying more depressive symptoms than girls. Furthermore, Karevold et al. (3), following a sample of 921 Norwegian children from 18 months to 12.5 years, reported that mother-reported shyness at age four was a predictor of parent and self-reported anxiety and parent-reported depression (the latter with a lower effect size) at 12.5 years. Similarly, Bohlin and Hagekull (32), in a sample of 100 participants, found that parent-reported shyness in infancy was a significant predictor of social anxiety and depression at 21 years as reported by participants themselves; however, the association between early shyness and later depression was no longer significant when the analysis controlled for social anxiety at age 21.

Overall, these findings from both concurrent and longitudinal studies are in line with a recent metanalysis which concluded that behavioral inhibition (a construct conceptually similar to shyness) in early childhood represents one of the main risk factors of subsequent anxiety, and especially social anxiety disorders (28). Yet, although the concurrent and longitudinal associations between shyness and internalizing problems have been empirically demonstrated, the roles of possible risk and protective factors that may exacerbate or mitigate such links over time are less clear (28).

In addition to emotional problems, research has also consistently shown shyness to be associated with language and socio-communicative difficulties, including less complex language and poorer expressive, pragmatic, and receptive language skills [for an overview, see Coplan et al. (2)]. Shy children are also found to speak less than less shy children in familiar and unfamiliar settings (33) and to show a skill delay in the social use of language (34).

Several processes behind the shyness and language problems link have been suggested, as summed up by Coplan and Evans (35). For instance, as language is learned through active participation, shy children may be less linguistically competent because their withdrawn demeanor and restricted verbal participation in social settings hampers their opportunities to acquire, practice, and develop language skills (i.e., "competence deficit"). Others suggest that shy children's poorer verbal abilities may rather reflect a "performance deficit" in which shy children's underlying social anxiety and wariness may act to inhibit these children's propensity to speak and respond in social settings (36). Support for this latter view comes from research showing that more shy children often score lower on tests of expressive language than on tests of receptive language (37).

Despite the vast body of studies linking shyness with adjustment difficulties and poor social and communicative functioning, it is clearly not the case that all shy children experience such difficulties. In this respect, a growing body of research has suggested several risk and protective factors that may influence shy children's developmental course, including biological factors (i.e., cortisol levels) and environmental factors (i.e., parental socialization practices, the quality of relationships with others) [for an overview, see Coplan et al. (13)].

A small body of studies has also explored the role of individual factors for shy children's socio-emotional functioning. For instance, studies have reported that the association between shyness and internalizing problems is lower among shy children with higher levels of temperamental activity or greater sports participation (38, 39). Furthermore, shy preschool-children with higher emotion-related competencies (i.e., ability to recognize the emotions of others) are found to show better social and emotional adjustment (i.e., less anxious-withdrawal and peer rejection) compared to shy children with lower levels of emotion recognition (30). Moreover, greater inhibitory control, a component of temperamental effortful control, is found to increase shy children's risk of negative adjustment, including heightened anxiety problems in kindergarten (8), higher levels of social anxiety, as well as less prosocial behaviors and more problematic peer interactions in both preschool and school settings (9, 40, 41).

Furthermore, as suggested by Coplan and Weeks (2), language *skills* could be a positive resource for shy children's socioemotional functioning. That is, shy children who are more able to communicate their thoughts and who are confident in their ability to use appropriate language may be less prone to feel anxious and wary around peers. Better language skills could also foster positive social interactions, and may, in this sense, be an essential tool that could aid shy children to make and keep friends. There is some support for this proposition from a handful of studies demonstrating that shy children who also are verbally skilled (i.e., expressive, receptive, and pragmatic language skills) tend to show less inhibition, loneliness, social anxiety, peer difficulties, and asocial behaviors compared to shy children who are less verbally skilled (2, 15, 42). Despite these research efforts, there is still a lack of longitudinal studies examining such pathways over time.

Moreover, relatively less is known about the role of shy children's social interaction skills and behaviors for their future socio-emotional and communicative functioning. As suggested by Asendorpf (24) as well as the "*shy but getting by*" model by Coplan et al. (13), such skills and behaviors are likely to promote resiliency and foster positive development among shy children by aiding in the formation of positive interactions and relationships with peers and others. In this sense, positive social skills, such as play behaviors with peers, may increase shy children's social engagement and their opportunities to learn and practice social and communicative skills, which ultimately could ameliorate their increased risk of language and internalizing problems.

There is some support for such assertions from studies showing that shy (i.e., anxious solitary) children with higher levels of social competencies (i.e., more agreeable) had higher quality peer relations and were better liked by peers compared to shy children with lower levels of social competencies (14, 16). Further, studies also show that shy children with higher levels of positive affect (i.e., positive facial expression, smiling) have fewer symptoms of social anxiety and display more sociability and advanced theory of mind compared to children with more negative affect (4, 7). Thus, considering these results, it is plausible to expect social competencies in the form of social play behaviors with peers to also influence the prospective link between early shyness and later adjustment and language functioning. To date, however, such interactions are yet to be explored empirically.

1.1. The present study

On this background, the present study aspires to (1) examine the long-term association between shyness in childhood (from age 18 months to five years) and later adjustment outcomes (language and internalizing difficulties) in school at ages eight and 11 years, and (2) explore the possible influence of early social play behaviors and language competencies as measured in preschool in these prospective links.

First, based on previous research (3, 35), we hypothesize that higher levels of early shyness will be positively associated with both language problems as well as with internalizing problems during the school years (at age eight and 11 years). However, in accordance with a previous meta-analysis (28), we expect that associations with anxiety symptoms will be stronger than associations with depressive symptoms.

Second, building on previous theorizing and empirical evidence (13, 15, 16, 24), we explore if differences in early social play behaviors and language competencies during the preschool years could influence the strength of these longitudinal associations. More specifically, we hypothesize that the associations between early shyness and later language and internalizing problems will decrease at higher levels of social play behaviors and language skills but increase at higher levels of language problems and lower levels of social play behavior with peers.

Finally, as previous research has indicated that social play behaviors and language competencies may act as mediators in the associations between shyness and adjustment outcomes (33, 43, 44), we also explored whether social play behaviors and language competencies would account for (i.e., mediate) the prospective associations between early shyness and later adjustment outcomes in the current study. In this sense, we hypothesize that higher shyness in childhood predicts less social play behaviors in preschool, which in turn, predict poorer language abilities and adjustment in school. Similarly, based on perspectives arguing that shy children's poor language abilities may reflect a "performance deficit" (because shy children's wariness and social reticence may inhibit their propensities to speak in social settings), we hypothesize that higher levels of childhood shyness predict poorer language competencies in preschool, which, in turn, will be prospectively associated with poorer adjustment and language competencies in school.

Previous research has also demonstrated gender differences in shyness, as well as in its associations with developmental outcomes (2, 45, 46), although such differences have not been consistently reported (47, 48). Studies also have shown parental socioeconomic factors to be associated with a variety of child outcomes (49, 50). For this reason, we included both gender and mother's education level in all our analyses.

2. Materials and methods

2.1. Participants and procedure

The participants of this study represent a sub-cohort from the Norwegian Mother, Father, and Child Cohort Study (MoBa). The MoBa study is a prospective population-based pregnancy cohort study conducted by the Norwegian Institute of Public Health (51, 52). Participants of the MoBa were recruited from all over Norway from 1999 to 2008. The women consented to participation in 40.6% of the pregnancies. The MoBa now includes 114,500 children, 95,200 mothers, and 75,200 fathers. Pregnancy and birth records from the Medical Birth Registry of Norway (MBRN) are linked to the MoBa database (53).

The sub-cohort of the current study includes a total of 7,447 children (50.1% girls). This sample consists of children born between 2006 and 2009 with ECEC teacher rated questionnaire data at five years of age. For this sub-cohort, we also included mother-rated data from child age 18 months, three, five, and eight years, and primary school teacher-rated data at child age 11 years (response rate = 51%).

The ECEC teachers (response rate = 40%) were recruited from all over Norway over a three-years period through invitation from the participating mothers, meaning that the sample was spread across different geographical locations. We have ECEC center ID on most of these children (n = 5,773) from across 2,738 ECEC centers. Among these children, the majority (n = 3,035) were the sole target-child in the center, whereas the remaining children were in the same ECEC center as one or more children in the sample. Although we have no information about whether these children were in the same department or not, there is a possibility that some children might have been rated by the same ECEC teacher and, thus, there is a possibility of interdependence between observations. However, we have previously explored the potential of clustering effects at the ECEC level (i.e., multiple children in the same ECEC center) in the subsample and found that results remained identical, which suggests that the effect of clustering is limited (50). Due to missing ID information for the schools included, we were not able to test for clustering effects at the primary school level. Thus, we cannot rule out the possibility of interdependence between observations at the school level.

The establishment of MoBa and initial data collection was based on a license from the Norwegian Data Protection Agency and approval from The Regional Committees for Medical and Health Research Ethics. The MoBa cohort is regulated by the Norwegian Health Registry Act. Written informed consent was obtained from all participants. The present research project is approved by the Regional Committees for Medical and Health Research Ethics (REK) (2015/1324). We use the twelth version of the quality-assured dataset released for research in 2019 (54).

2.2. Measures

2.2.1. Shyness

Mothers assessed child shyness at child age 18 months, three, and five years *via* the shyness subscale of the *Emotionality, Activity, and Sociability Temperament Survey–Short Form* [EAS; (55)]. Previous studies have demonstrated satisfactory psychometric properties for the shyness subscale (56). This subscale originally includes five items rated on a 5-point scale (from 1 = *not typical* to 5 = *very typical*), but only three questions were included for use in the MoBa questionnaire (i.e., "Is very social," "Is very friendly with strangers," both reversed, and "Takes a long time to warm up to strangers"). The Cronbach's alpha for the shyness subscales was 0.65 at age 18 months, 0.67 at age three years, and 0.71 at age five years.

2.2.2. Social play behaviors

At child age five years, ECEC teachers rated the target child's play behaviors with peers using the social play subscale of the Preschool Play Behavior Scale [PPBS; (57)]. The subscale comprises five items that assess social play in terms of the extent to which the child engages in peer conversation ("Engages in active conversations with other children during play") and in group interaction [e.g., "Plays in groups with (and not just beside) other children"], with response categories ranging from 1 = *never* to 5 = *very often*. The subscale is previously shown to display acceptable psychometric properties, including high internal reliability (α = 0.96) and good construct validity (57). The PPBS instrument has been translated and back-translated and used in several different cultures, including Italy (44), Finland (58), Korea (59), Norway (60), Malaysia (61), and Turkey (62). The internal reliability (α) for the social play subscale in the current study was 0.66.

2.2.3. Language competencies

At child age five years, ECEC teachers rated the target child's language competencies using a combination of items from two language subscales of the Child Development Inventory [CDI; (63)]. Five items were taken from the originally 50-items verbal comprehension subscale [i.e., "Tells where he(she) lives, naming town or city," "Uses the words "today," "yesterday," and "tomorrow" correctly] while four items were taken from the originally 50-items expressive language subscale (i.e., "Asks the meaning of words," "Uses irregular plurals correctly, for example, says "men," not "mans"), with dichotomous response categories (1 = *no*, 2 = *yes*). Previous studies have demonstrated acceptable psychometric properties of the CDI, including internal reliability and construct and predictive validity (64). The polychoric reliability of the teacher-rated language competence at age five years was 0.69.

At child age eight years, mothers rated the child's language competencies using the checklist of 20 statements about language difficulties (65). The checklist is a validated Norwegian instrument used to identify children with receptive, semantic, and expressive language difficulties. Eight of the original 20 items were selected for use in the MoBa (e.g., "Is often struggling finding the right words," "Has difficulties understanding the meaning of common words"), with statements rated on a 5-point scale (from 1 = "*Does not fit the child/absolutely wrong*" to 5 = "*Fits well with the child, absolutely right*"). The polychoric reliability of the mother-rated and teacher-rated language competencies at age eight were 0.85 and 0.78, respectively.

At child age 11, school teachers rated the target child's language competencies using the Children's Communication Checklist [CCC-2; (66)]. The CCC-2 is a screening instrument used to identify language impairment in children that originally includes ten subscales with seven items each. Twelve items were selected for use in the teacher questionnaire, comprising word-finding

difficulties, appropriate use of language, coherence, and syntax (e.g., "Forgets words s/he knows," "Mixes up words of similar meanings," "Can produce long and complicated sentences such as: When we went to the park I had a go on the swings;" "I saw this man standing on the corner," "Uses terms like "he" or "it" without making it clear what s/he is talking about") rated on a 5-point scale (from 1 = "*Does not fit the child/never*" to 5 = "*Fits well with the child/always*"). Previous studies have shown the CCC-2 to have good psychometric properties (67). The polychoric reliability of language competencies at age 11 years in this study was 0.84.

2.2.4. Internalizing problems

Children's anxiety symptoms were measured at age eight (mother reports) and at age 11 years (teacher reports) using the short version of the Screen for Child Anxiety Related Disorders [SCARED; (68)]. The SCARED is a multidimensional instrument intended to measure anxiety symptoms corresponding to DSM-defined anxiety disorders. The instrument originally contains 41 items covering five subscales, but the five-item short form was selected for use in the MoBa (i.e., "The child gets really frightened for no reason at all," "People tell the child that he/she worries too much"), with response categories ranging from 1 = *Not true* to 3 = *True*. The short form is previously found to have good psychometric properties similar to the full version (69). The polychoric reliability of anxiety symptoms was 0.66 at age eight years and 0.67 at age 11 years.

Children's depressive symptoms were measured at age eight (mother reports) and at age 11 (teacher report) using the Short Mood and Feelings Questionnaire [SMFQ; (70)]. The SMFQ consists of 13-items based on DSM-III-R criteria for depression, composed by descriptive phrases regarding how the individual has been feeling or acting recently (e.g., "Didn't enjoy anything at all," "Felt s/he was no good anymore"), with response categories ranging from 1 = *Not true* to 3 = *True*. The SMFQ is found to have good psychometric properties (71). The polychoric reliability of depressive symptoms was 0.79 at age eight years and 0.76 at age 11 years.

2.2.5. Covariates

Gender and maternal education were included as covariates in the analyses. Gender was indexed using birth records of boys and girls (50.1%) from the Medical Birth Registry of Norway. Maternal education was measured using mother's self-reported level of education derived from the MoBa 15th weeks of pregnancy questionnaire with response categories ranging from nine-years secondary school to University/College over four years. Due to the small number of participants in the lowest categories, the education variable was reduced to three categories scored as: (1) up to high school education (20.4%), (2) higher education college/university up to four years (44.5%), and (3) higher education college/university more than four years (35.1%).

2.3. Statistical analysis

All analyses were performed within a structural equation modeling framework using MPlus version 8.2 (72). Full information maximum likelihood with robust standard errors (MLR) was used to handle missing data and to correct test statistics and standard errors for non-normality of the observations (73). Model fit was evaluated by values of the Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) above 0.95 and by Root Mean Square of Approximation (RMSEA) below 0.05 (74).

Analyses were carried out in several steps. First, measurement models for all study variables were estimated by using confirmatory factor analyses (CFA) whereby we constructed one latent factor for each of the variables based on their respective indicators. Second, we tested measurement invariance of shyness across the three time points by comparing a baseline model (i.e., configural invariance) against a series of increasingly restricted models (i.e., weak invariance and strong invariance), following Widaman et al. (75). In the configural invariance model, we estimated the first loading and the first intercept, while the corresponding first factor loadings and factor intercepts were constrained to be invariant over time. In the weak invariance model, we added across-time invariance constraints on the remaining factor loadings, and in the strong invariance model, across-time invariance constraints were also placed on the remaining factor intercepts. The model fit of the most restricted invariance model (i.e., strong invariance) was adequate [$\chi^2(21) = 1145.01$, RMSEA = 0.025 (95% CI: 0.024, 0.027), CFI = 0.99, TLI = 0.98, SRMR = 0.026] and not significantly worse than the less restricted models [$\Delta\chi^2(2) = 16.71$, $p > 0.05$].

This baseline measurement model was then used to construct a second order latent childhood shyness factor based on the three latent shyness factors. We established an approximate standard metric by constraining the first factor loading of the shyness factor to its specific value and by setting the mean of the latent shyness factor at the first time point to 0 and the variance of the factor to 1.

Third, we examined the prospective associations from the early childhood shyness latent factor as well as from the latent social play behavior and language competencies factors at age five years to later language and internalizing problems at age eight and age 11 years by using multiple regression analyses, controlling for gender and maternal education. For the outcomes at age eight years, all the preschool predictor variables were simultaneously included. For the outcomes at age 11 years, we estimated both univariate (including only the preschool predictor variables) and multivariate models (controlling for previous levels of the variable, for instance; anxiety at age eight for anxiety at age 11 years).

Fourth, we tested whether early social play behaviors and language competencies moderated associations of childhood shyness with language problems and internalizing problems by estimating a series of latent moderation structural equation models [LMS; (76)], one for each outcome variable at child age eight and 11 years. The LMS approach produces estimates of interaction that are not attenuated by measurement errors, which in turn serves to increase power as well as reducing the likelihood of biased estimates (77). In each model, the predictor (latent childhood shyness), the moderator in question (social play behavior, language competence), and the product term of these variables were simultaneously included as predictors of the outcome variables, while also controlling for gender and maternal education. Simple slopes follow-up analyses were then conducted to further probe the association between childhood shyness and the outcome variables at different levels of the moderator variables, specified to low (−1 SD below the mean), average, and high levels (+1 SD above the mean) of the moderator variables. Prior to all analyses, we

10.3389/fpsyt.2023.1120109

TABLE 1 Polychoric intercorrelations between study variables and descriptive statistics of variables.

	1	2	3	4	5	6	7	8	9	10	11	*M* (*SD*)	Range
1. Shyness 1.5 years (m)												2.05 (0.64)	1–5
2. Shyness 3 years (m)	0.69**											2.21 (0.68)	1–5
3. Shyness 5 years (m)	0.50**	0.77**										2.09 (0.71)	1–5
4. Social PB 5 years (kt)	−0.01	−0.03	−0.05*									4.41 (0.56)	1–5
5. Lang. Comp. 5 years (kt)	−0.02	−0.05*	−0.02	0.39**								1.88 (16)	1–2
6. Lang. Prob. 8 years (m)	0.07*	0.11**	0.10**	−0.26**	−0.51**							1.32 (0.48)	1–5
7. Anxiety 8 years (m)	0.12**	0.21**	0.29**	−0.08*	−0.06*	0.24**						1.20 (0.24)	1–3
8. Depressive 8 years (m)	0.01	0.04*	0.07**	−0.08**	−0.09**	0.25**	0.45**					1.14 (0.19)	1–3
9. Lang. Prob. 11 years (t)	0.00	0.02	0.01	−0.13**	−0.26**	0.25**	0.04	0.09**				1.37 (0.43)	1–4
10. Anxiety 11 years (t)	0.04	0.09**	0.13**	−0.10*	−0.12**	0.19**	0.45**	0.22**	0.15**			1.13 (0.22)	1–3
11. Depressive 11 years (t)	−0.04	−0.01	0.01	−0.07*	−0.10*	0.09**	0.20**	0.20**	0.12**	0.47**		1.13 (0.28)	1–3
12. Gender	0.11**	0.07*	0.02	0.18**	0.09**	−0.07**	0.05*	−0.01	−0.07**	0.04	−0.06*		
13. Mother education	−0.03*	−0.02	0.00	0.04	0.08**	−0.07**	−0.03	−0.06**	−0.05*	−0.05*	−0.02		

All variables are latent factors except gender (girls = 1) and mother education, Social PB = social play behavior; Lang. Comp. = language competencies; Lang. Prob. = language problems; (m) = mother reports; (kt) = ECEC teacher reports; (t) = school-teacher reports; *M* = mean scores; *SD* = standard deviation, $^{*}p < 0.05$, $^{**}p < 0.01$.

standardized the latent variables by setting their variances to 1 and freeing their first indicator loadings. We also tested for gender differences in all analyses.

Finally, we estimated several indirect models for each of the mediator variables, social play behaviors and language competencies, where these variables were defined as putative mediators in the association between early shyness and each of the outcome variables at age eight and 11 years, respectively, controlling for gender and maternal education. For these models, we applied path analyses and estimated the indirect paths and their confidence intervals by using bootstrapping (78), and tested for gender differences by comparing constrained paths with unconstrained pats. In the indirect models for the outcome variables at age 11 years, we also controlled for previous levels of the variable in question.

3. Results

Descriptive statistics (i.e., means, standard deviations, and range) and polychoric (i.e., latent) intercorrelations among the study variables are presented in Table 1. The patterns of associations were mostly as expected. There were high intercorrelations between the three shyness measures across time points. Further, shyness across all three time points was positively correlated with both language problems and anxiety at age eight. Language competency at age five years was only negatively associated with shyness at age three years, and social play behaviors at age five years was only negatively associated with shyness at age five years. Shyness at both ages three and five years was positively correlated with depressive symptoms at age eight years and with anxiety at age 11 years.

Social play behavior was positively associated with language competencies and negatively associated with anxiety and depressive symptoms at both time points. Language competence at all time points was negatively correlated with anxiety and depressive symptoms at both age eight and 11 years. Gender (i.e., being a girl) was positively correlated with shyness at age 18 months and age three years, social play behaviors at age five, language competence at all time points, and with anxiety at age eight. Higher mother education was positively correlated with language competence at all time points and negatively correlated with depressive symptoms at age eight years.

3.1. Direct path analyses

Concerning the outcome variables at age eight years (see Table 2), results from the multiple regression analyses revealed that childhood shyness was positively and significantly predictive of language problems and of anxiety and depressive symptoms. Further, ECEC teacher-reported social play behavior at age five years was negatively predictive of mother-reported language and internalizing difficulties, whereas ECEC teacher-reported language competency in preschool was only negatively predictive of later language problems as reported by mothers.

With regards to the outcome variables at age 11 years, results from the univariate analyses showed mother-rated childhood shyness and ECEC teacher-reported social play behaviors and language competencies in preschool to be significantly predictive of teacher-reported anxiety symptoms, and early language competencies in preschool to be negatively predictive of teacher-reported depressive symptoms. However, these associations were no longer significant when we included previous levels of the outcome variables at age eight in the analyses (see Table 2).

3.2. Moderation analyses

Results from the latent moderation analyses showed a few significant interaction effects. First, the childhood shyness x social play behavior interaction effect was significant for mother-rated anxiety symptoms at age eight. The negative coefficient of the interaction term ($b = -0.09$, $p < 0.001$) indicates that

10.3389/fpsyt.2023.1120109

TABLE 2 Results from univariate and multivariate regression analysis with childhood shyness and social play behaviors and language competencies at age 5 years as predictors of internalizing and language problems at age 8 and 11 years.

Predictors	Childhood shyness age 1.5–5	Social play behaviors age 5	Language competencies age 5	Language problems age 8	Anxiety symptoms age 8	Depressive symptoms age 8
	β (SE)	β (SE)	β (SE)	β (SE)	β (SE)	β (SE)
Outcomes age 8 years						
Language problems	0.09** (0.02)	−0.06* (0.02)	−0.48** (0.02)			
Anxiety symptoms	0.24** (0.03)	−0.07* (0.03)	−0.04 (0.03)			
Depressive symptoms	0.05* (0.02)	−0.05* (0.02)	−0.05 (0.03)			
Outcomes age 11 years	*Univariate analyses*					
Language problems	0.00 (0.02)	−0.02 (0.03)	−0.24** (0.04)			
Anxiety symptoms	0.09** (0.03)	−0.09* (0.04)	−0.09* (0.04)			
Depressive symptoms	−0.02 (0.03)	−0.03 (0.04)	−0.09* (0.04)			
	Multivariate analyses					
Language problems	−0.01 (0.02)	−0.01 (0.03)	−0.15** (0.04)	0.17** (0.03)	−0.02 (0.03)	0.03 (0.03)
Anxiety symptoms	−0.00 (0.03)	−0.05 (0.04)	−0.04 (0.05)	0.06 (0.04)	0.42** (0.04)	−0.00 (0.03)
Depressive symptoms	−0.05 (0.03)	−0.02 (0.04)	−0.08 (0.05)	−0.02 (0.04)	0.14** (0.04)	0.13** (0.03)

*$p < 0.05$, **$p < 0.001$. All analyses controlled for gender and maternal education.

the otherwise positive association between childhood shyness and later anxiety in school-age decreased at higher levels of social play behaviors in preschool. Second, there was also a significant interaction effect of childhood shyness x language competencies for anxiety symptoms at age eight, where the negative coefficient of the interaction term ($b = -0.14$, $p < 0.001$) indicates that the positive association between shyness and anxiety decreased at higher levels of language competencies. Results from simple slopes further confirmed this, by showing that the association with anxiety symptoms steadily decreased at higher levels of the two moderator variables (see Table 3). Figures 1, 2 illustrate the graphical plot of these interaction effects, demonstrating that when early social play behavior increased by one unit, the association between shyness and anxiety became less strong, decreasing by 0.09 standard deviations (Figure 1). Similarly, when language competencies increased by one unit, the association between shyness and anxiety decreased by 0.14 standard deviations (Figure 2). No interaction effects of early social play behaviors or language competencies in preschool were found for the associations between childhood shyness and the other outcome variables (i.e., depressive symptoms and language problems).

TABLE 3 Results from interaction analyses including tests of simple slopes of interaction of the moderators social play behaviors and language competencies with 95% confidence intervals.

	Anxiety symptoms age 8 years		
	b	[95% CI]	β (SE)
Model 1: Social play behaviors			
Childhood shyness (*x*)	0.12**	[0.098, 0.141]	0.24** (0.04)
Social play behaviors (*w*)	−0.04**	[−0.054, −0.019]	−0.07** (0.03)
Shyness*Social play behaviors (*xw*)	−0.09**	[−0.105, −0.068]	−0.12** (0.04)
Simple slopes			
−1 *SD* below the mean	0.21**	[0.171, 0.241]	
Mean	0.12**	[0.098, 0.141]	
+1 *SD* above the mean	0.03**	[0.014, 0.052]	
Model 2: Language competence			
Childhood shyness (*x*)	0.11**	[0.082, 0.135]	0.24** (0.05)
Language competencies (*w*)	−0.06**	[−0.091, −0.037]	−0.09** (0.05)
Shyness*Language competencies (*xw*)	−0.14**	[−0.173, −0.113]	−0.16** (0.05)
Simple slopes			
−1 *SD* below the mean	0.25**	[0.205, 0.299]	
Mean	0.11**	[0.082, 0.135]	
+1 *SD* above the mean	−0.03*	[−0.066, −0.002]	

x = predictor variable; w = moderator variable; xw = interaction term; 95% CI = 95% confidence interval; SE = standard error; *$p < 0.05$, **$p < 0.01$. All analyses controlled for gender and maternal education.

3.3. Indirect path analyses

Results showed no evidence of indirect effects of social play behaviors or language competencies in preschool in the links from childhood shyness to the three outcome variables at age eight and 11 years. However, results did indicate stability in the indirect pathways from childhood shyness to each of the outcome variables throughout childhood. More specifically, there was a significant indirect path from childhood shyness to teacher-rated anxiety symptoms at age 11 years through mother-reported anxiety symptoms at age eight [β = 0.103, 95% CI (0.072, 0.145), $p < 0.001$]; from childhood shyness to teacher-rated depressive symptoms at age 11 years through mother-rated depressive symptoms at age eight [β = 0.009, 95% CI (0.003, 0.018), $p < 0.001$]; and

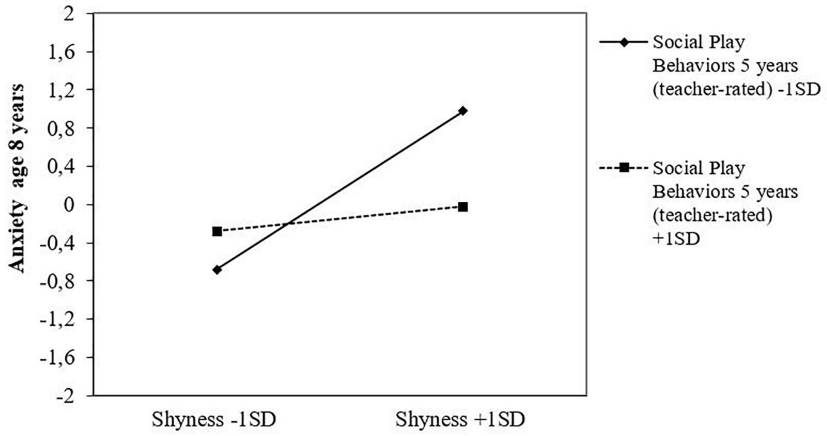


FIGURE 1
Social play behaviors at age 5 years as a protective factor in the association between childhood shyness and symptoms of anxiety at age 8 years, as reported in standard deviations.

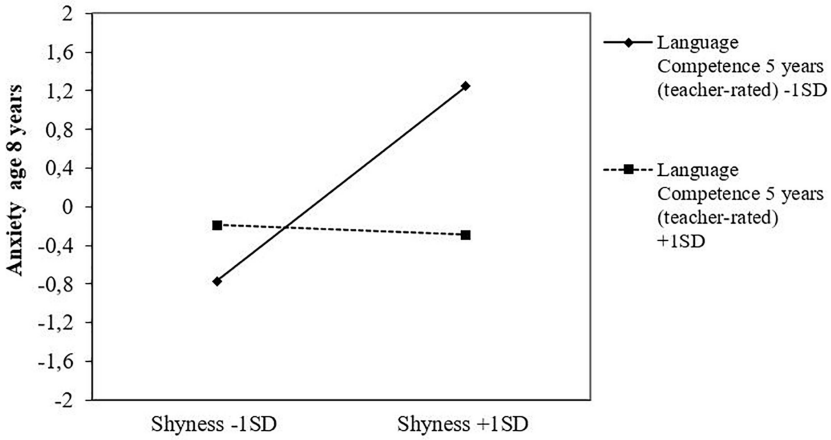


FIGURE 2
Language competencies at age 5 years as a protective factor in the association between childhood shyness and anxiety symptoms at age eight, as reported in standard deviations.

from childhood shyness to teacher-rated language problems at age 11 years through mother-rated language problems at age eight [$\beta = 0.016$, 95% CI (0.009, 0.021), $p < 0.001$].

4. Discussion

The overall scope of the current study was to explore the long-term association between shyness in childhood and later adjustment outcomes (language and internalizing difficulties) in school, and secondly, to explore the role of early social play behaviors and language competencies in preschool in these prospective links.

Among the results, a higher level of shyness in childhood was prospectively predictive of later language problems and symptoms of anxiety and depression in early school age. Second, results showed higher levels of social play behaviors and language competencies in preschool to serve a protective role for shy children's risk of later internalizing difficulties by significantly moderating (i.e., reducing) the prospective associations from childhood shyness to anxiety symptoms at age eight. In contrast, there were no indications that early social play behaviors and language competencies accounted for (i.e., mediated) the prospective links from early shyness to later adjustment difficulties. A closer elaboration of the results and their implications follow below.

4.1. The emotional functioning of shy children

In this study, results revealed that childhood shyness, as measured across 18 months, and three and five years, predicted symptoms of anxiety and depression later in childhood, both directly at age eight (mother-ratings), and indirectly at age 11 (teacher-ratings) through previous symptom levels at age eight. In this sense, the results are suggestive of some degree of stability in the longitudinal pathways from early shyness to later internalizing

difficulties throughout the childhood years. However, importantly, the significant association between shyness and later depressive symptoms was weaker than the longitudinal association between shyness and later anxiety symptoms, indicating that shyness represents a greater risk factor for anxiety more than for depression in childhood. This finding aligns with previous studies reporting stronger associations of shyness with anxiety, particularly social anxiety, than other internalizing difficulties (3, 28, 32, 79). In other words, the results of our study bring some support to the notion that temperamental shyness in childhood, characterized by excessive wariness in novel social contexts and with new people, may represent one of the strongest risk factors of anxiety in the subsequent development phases (80). Furthermore, the age period considered in the current study (i.e., school-age) might be an early stage for developing depressive problems, which may emerge in the following developmental periods (3). Thus, identifying shy children at risk in the early phases of development could be helpful to reduce the risk for later internalizing problems, especially concerning anxiety symptoms.

4.2. The socio-communicative functioning of shy children

With respect to language problems, our results corroborated with previous research findings demonstrating shy children's increased risk of language difficulties, including poorer pragmatic, expressive and receptive language abilities (2).

However, there has been less agreement about the extent to which such difficulties may reflect a "performance deficit," that is, whereby shy children's fearful and anxious demeanor may directly inhibit their propensity to speak in social situations (81, 82), or whether such difficulties may rather reflect a "competence deficit," whereby shy children's withdrawn and restricted participation in social interaction may influence these children's opportunities to learn and practice language skills (83). In the former case, one would expect language difficulties to account for (i.e., mediate) the links between shyness and poor adjustment, whereas in the latter case, one would expect language difficulties to influence (i.e., moderate) the strength of such associations.

In many respects, the results of the current study add important knowledge to this ongoing debate. While there was no evidence of mediation effects of language skills for any of the prospective links, the results showed language competencies in preschool to moderate the longitudinal links between early shyness and later anxiety symptoms. More specifically, this moderating effect suggests that shyness and language skills represent two separate characteristics of the child, which, when co-occurring as high shyness and low language skills, may jointly put the child at risk of anxiety symptoms in the long run. However, when high shyness is accompanied by high language skills, shy children's risk of later anxiety may decrease significantly. In this sense, our results primarily provide support for the view that language abilities may largely reflect a "competence deficit" rather than a "performance deficit." Thus, bearing in mind the crucial impact of language skills for shy children's adjustment in several developmental areas (2, 15, 42), our findings may have important implication for prevention purposes insofar as they highlight the potentially positive benefits of targeting shy children's language abilities at an early age. Importantly, these results also indicate that language difficulty is not necessarily a defining feature of all shy children, but rather suggest that heterogeneity in shy children's language abilities is likely to depend on the influence of other individual and/or environmental factors.

4.3. The social functioning of shy children

Additionally, the current study also demonstrated the protective benefits of early social play behaviors with peers for shy children's later adjustment. More specifically, the association between childhood shyness and symptoms of anxiety at age eight was stronger at lower levels of social play behaviors but was found to decrease significantly at higher levels of social play behaviors. Previous research has, indeed, confirmed the benefits of positive social actions for experiencing positive emotions, sense of belonging, and overall well-being (84, 85). As such, this result adds to the growing body of research showing positive social behaviors to buffer against negative adjustment outcomes for shy children, for instance such as peer problems (14, 16) and social anxiety (4, 7).

Drawing on previous suggestions, a possible mechanism behind such links could be that positive social behaviors and competencies are likely to facilitate more peer liking and more positive interactions with others, which ultimately may help reduce shy children's risk of socioemotional problems (4). As such, shy children who practice social behaviors and skills may gradually familiarize themselves with others and, consequently, feel better and less socially wary and anxious in social situations. In this sense, the findings of our study add to the growing literature suggesting that when shyness is accompanied with positive behaviors or characteristics, it becomes less strongly associated with anxiety.

4.4. Gender differences

Although gender correlated significantly with several of the study variables, we did not find any significant gender differences in any of the associations between the study variables. In past research, there have been contradictory findings concerning this issue, with some studies reporting stronger associations between shyness and internalizing symptoms among boys relative to girls (45), while others find that such associations are stronger for girls than for boys or that there are no gender differences at all (86, 87). Potential reasons for this inconsistency in the findings might be due to differences in *how* shyness is operationalized and measured (i.e., as social withdrawal, conflicted shyness, or social disinterest) across different studies, as well as in *when* assessments are made (i.e., early vs. later childhood). For instance, although studies often show that there are no gender differences in shyness overall, there are indications that girls tend to "over-report" their shyness in middle and later childhood (86), which then could mask potential gender differences in associations with outcomes (88). Accordingly, further research into age-specific gender differences in the longitudinal associations between shyness (including different types of shyness) and developmental outcomes (i.e., social anxiety, loneliness) is clearly warranted.

5. Limitations

Despite the benefits of a longitudinal design, large sample size, and performing the analyses within a SEM framework, the present study also has limitations.

First, the correlational nature of this study precludes us from drawing conclusions with respect to causality and direction of associations. For instance, it has been suggested that the direction of influence may not only flow from shyness to poor language, but that lower language abilities may also lead to shyness (2, 35). However, there is limited support for this suggestion with research showing that such patterns may mainly exist among boys but not girls (36).

Second, we measured shyness by using the short form of the EAS which only includes three of the original five items. This may be problematic with respect to possible discrepancies in how shyness was operationalized and measured in this study. Yet, previous research has shown the short form to have satisfactory psychometric properties, including reliability and validity estimates approaching those of the original scale and with high correlations (r = 0.95) observed between the short-form and the original form (89). As such, these similarities may indicate that the short form, despite its limited number of items, is sufficient in terms of capturing the most essential and core features of the shyness phenomenon among children and youth.

Third, the measure of anxiety symptoms in the current study taps general anxiety, whereas there is evidence to suggest that shyness is most strongly associated with social anxiety (28). This may partly explain why the direct association between shyness and anxiety at age 11 years was not significant. Thus, future studies should examine longitudinal associations between early shyness and specific types of anxiety symptoms across different phases of development.

Fourth, the effect sizes for the associations between the study variables were small to moderate, and this warrants that our results should be interpreted with caution. The small effect sizes are problematic because although we demonstrate statistically significant results, this does not necessarily mean that they have practical significance, which is an important issue to consider with regards to intervention purposes. However, given that the assessment points expanded over a long period of time, we did not expect to see large effect sizes in this study. It is possible that the vast number of idiosyncratic experiences occurring within these formative child years may have contributed to the children's socioemotional adjustment and language development above and beyond the contribution from the included variables in this study. Another possibility is that the over-representation of well-functioning and well-educated families in this study compared to the population in general (90), might have led to an underestimation of true effect sizes.

Fifth, the validity and generalizability of the study findings may be restricted by general limitations of the MoBa sample, such as attrition, selection, and non-response bias. For instance, problems with self-selection bias and attrition may have resulted in biased estimates of the associations and underestimation of effect sizes (90). Recent research suggests using multiple imputation or inverse probability weighting to account for selection bias present in the MoBa cohort due to loss to follow-up (91). However, others question the appropriateness of using such imputation techniques uncritically as not all associations necessarily are impacted by selection bias (92). In the current study, we applied full information maximum likelihood with robust estimators (MLR) to handle missing data, following recommendations of Lodder et al. (73).

Sixth, we had a valid ECEC center ID for around 78% of the sample but no equivalent ID at the school level in the study. Thus, we cannot rule out the possibility of interdependence between the observations in cases where the same teachers reported on more than one target child. However, the issue on non-independence in observations should not be a substantial concern as the children participating in the MoBa are dispersed across different ECEC centers and schools all over Norway. Furthermore, we have in previous research using the same subsample shown that results remained the same when we adjusted standard errors for clustering at the ECEC level to allow for interdependence in the observations (50). Together, these aspects suggest that the effect of clustering is rather limited.

Finally, as our investigation involved Norwegian children, their mothers, and teachers, the generalizability of the findings may be limited to Norwegian contexts.

6. Conclusion

In sum, the findings of the current study address some of the shortages in the literature concerning which early behavioral child characteristics that may influence the strength and direction of the prospective associations between childhood shyness and later internalizing and language problems. Our results provide empirical support to the theoretical propositions that positive behavioral features, such as social play behaviors and language competencies, may be particularly adaptive for shy children's socio-emotional functioning and adjustment (13). As such, this study adds to the emerging body of research demonstrating the importance of exploring how traits may operate in an interactive manner in influencing shy children's developmental outcomes (6, 93). In this sense, the present study offers novel input for both developmental and child personality research by providing evidence in support of a more heterogeneous and nuanced conceptualization of the shyness dimension. Most importantly, the above findings offer some optimistic implications for shy children by showing that positive behavioral assets, such as social play behaviors and language competencies, may buffer against these children's increased risk of internalizing problems. Future intervention training programs should aim to reinforce shy children's social behavior and communication skills, both to facilitate and aid their desire to interact and being accepted by others, but also to reduce their inhibited and withdrawn behaviors and thereby their subsequent risk for internalizing difficulties.

Data availability statement

The original contributions presented in this study are included in this article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

Acknowledgments

The Norwegian Mother, Father, and Child Cohort Study was supported by the Norwegian Ministry of Health and Care Services and the Ministry of Education and Research. We are grateful to all the participating families in Norway who take part in this on-going cohort study.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

1. Crozier WR. Shyness and self-esteem in middle childhood. *Br J Educ Psychol.* (1995) 65:85–95. doi: 10.1111/j.2044-8279.1995.tb01133.x

2. Coplan RJ, Weeks M. Shy and soft-spoken: shyness, pragmatic language, and socio-emotional adjustment in early childhood. *Infant Child Dev.* (2009) 18:238–54. doi: 10.1002/icd.622

3. Karevold EB, Ystrøm E, Coplan RJ, Sanson AV, Mathiesen KS. A prospective longitudinal study of shyness from infancy to adolescence: stability, age-related changes, and prediction of socio-emotional functioning. *J Abnorm Child Psychol.* (2012) 40:1167–77. doi: 10.1007/s10802-012-9635-6

4. Colonnesi C, Napoleone E, Bögels SM. Positive and negative expressions of shyness in toddlers: are they related to anxiety in the same way? *J Pers Soc Psychol.* (2014) 106:624. doi: 10.1037/a0035561

5. Eggum-Wilkens ND, Lemery-Chalfant K, Aksan N, Goldsmith HH. Self-conscious shyness: growth during toddlerhood, strong role of genetics, and no prediction from fearful shyness. *Infancy.* (2015) 20:160–88. doi: 10.1111/infa.12070

6. Poole KL, Van Lieshout RJ, Schmidt LA. Shyness and sociability beyond emerging adulthood: implications for understanding the developmental sequelae of shyness subtypes. *J Soc Clin Psychol.* (2017) 36:316–34. doi: 10.1521/jscp.2017.36.4.316

7. Poole KL, Schmidt LA. Smiling through the shyness: the adaptive function of positive affect in shy children. *Emotion.* (2019) 19:160. doi: 10.1037/emo0000426

8. White LK, McDermott JM, Degnan KA, Henderson HA, Fox NA. Behavioral inhibition and anxiety: the moderating roles of inhibitory control and attention shifting. *J Abnorm Child Psychol.* (2011) 39:735–47. doi: 10.1007/s10802-011-9490-x

9. Sette S, Hipson WE, Zava F, Baumgartner E, Coplan RJ. Linking shyness with social and school adjustment in early childhood: the moderating role of inhibitory control. *Early Educ Dev.* (2018) 29:675–90. doi: 10.1080/10409289.2017.1422230

10. Hassan R, Poole KL, Schmidt LA. Revisiting the double-edged sword of self-regulation: linking shyness, attentional shifting, and social behavior in preschoolers. *J Exp Child Psychol.* (2020) 196:104842. doi: 10.1016/j.jecp.2020.104842

11. Hassan R, Schmidt LA. Longitudinal investigation of shyness and physiological vulnerability: moderating influences of attention biases to threat and safety. *Dev Psychobiol.* (2021) 63:e22180. doi: 10.1002/dev.22180

12. Susa-Erdogan G, Benga O, Colonnesi C. Expressions of positive and negative shyness in preschool-age children: temperamental correlates and visual attention to emotions. *J Exp Child Psychol.* (2022) 215:105315. doi: 10.1016/j.jecp.2021.105315

13. Coplan RJ, Baldwin D, Wood KR. Shy but getting by: protective factors in the links between childhood shyness and socio-emotional functionings. In: Schmidt LA, Poole KL editors. *Adaptive Shyness: Multiple Perspectives on Behavior and Development*. New York, NY: Springer (2020). p. 63–87.

14. Gazelle H. Behavioral profiles of anxious solitary children and heterogeneity in peer relations. *Dev Psychol.* (2008) 44:1604–24. doi: 10.1037/a0013303

15. Cheung HS, Elliott JM. Child shyness and peer likeability: the moderating role of pragmatics and vocabulary. *Br J Dev Psychol.* (2017) 35:531–45. doi: 10.1111/bjdp.12192

16. Gazelle H, Shell MD. Behavioral profiles of anxious solitary children: predicting peer relations trajectories from Third through Fifth Grades. *Merrill Palmer Q.* (2017) 63:237–81. doi: 10.13110/merrpalmquar1982.63.2.0237

17. Jahng KE. The moderating effect of children's language abilities on the relation between their shyness and play behavior during peer play. *Early Child Dev Care.* (2018) 190:2106–18. doi: 10.1080/03004430.2018.1560277

18. Asendorpf JB. Development of inhibited children's coping with unfamiliarity. *Child Dev.* (1991) 62:1460–74. doi: 10.1111/j.1467-8624.1991.tb01618.x

19. Coplan RJ, Prakash K, O'Neil K, Armer M. Do you "want" to play? Distinguishing between conflicted shyness and social disinterest in early childhood. *Dev Psychol.* (2004) 40:244–58. doi: 10.1037/0012-1649.40.2.244

20. Rubin KH, Coplan RJ. *The Development of Shyness and Social Withdrawal.* New York, NY: Guilford (2010).

21. Bohlin G, Hagekull B, Andersson K. Behavioral inhibition as a precursor of peer social competence in early school age: the interplay with attachment and nonparental care. *Merrill Palmer Q.* (2005) 51:1–19. doi: 10.1353/mpq.2005.0001

22. Coplan RJ, Arbeau KA. The stresses of a "brave new world": shyness and school adjustment in kindergarten. *J Res Child Educ.* (2008) 22:377–89. doi: 10.1080/02568540809594634

23. Coplan RJ, Rose-Krasnor L, Weeks M, Kingsbury A, Kingsbury M, Bullock A. Alone is a crowd: social motivations, social withdrawal, and socioemotional functioning in later childhood. *Dev Psychol.* (2013) 49:861–75. doi: 10.1037/a0028861

24. Asendorpf JB. Beyond social withdrawal: shyness, unsociability, and peer avoidance. *Hum Dev.* (1990) 33:250–9. doi: 10.1159/000276522

25. Schmidt LA, Fox NA. Conceptual, biological, and behavioral distinctions among different categories of shy children. In: Schmidt LA, Schulkin J editors. *Series in Affective Science: Extreme Fear, Shyness, and Social Phobia: Origins, Biological Mechanisms, and Clinical Outcomes*. New York, NY: Oxford University Press (1999). p. 47–66.

26. Jones KM, Schulkin J, Schmidt LA. Shyness: subtypes, psychosocial correlates, and treatment interventions. *Psychology.* (2014) 5:244–54. doi: 10.4236/psych.2014.53035

27. Sang B, Ding X, Coplan RJ, Liu J, Pan T, Feng X. Assessment and implications of social avoidance in Chinese early adolescents. *J Early Adolesc.* (2016) 38:554–73. doi: 10.1177/0272431616678988

28. Sandstrom A, Uher R, Pavlova B. Prospective association between childhood behavioral inhibition and anxiety: a meta-analysis. *Res Child Adolesc Psychopathol.* (2020) 48:57–66. doi: 10.1007/s10802-019-00588-5

29. Coplan RJ, DeBow A, Schneider BH, Graham AA. The social behaviours of inhibited children in and out of preschool. *Br J Dev Psychol.* (2009) 27:891–905. doi: 10.1348/026151008X396153

30. Sette S, Baumgartner E, Laghi F, Coplan RJ. The role of emotion knowledge in the links between shyness and children's socio-emotional functioning at preschool. *Br J Dev Psychol.* (2016) 34:471–88. doi: 10.1111/bjdp.12144

31. Poole KL, Cunningham CE, Schmidt LA. Trajectories of observed shyness and psychosocial adjustment in children. *Child Psychiatry Hum Dev.* (2020) 51:636–47. doi: 10.1007/s10578-020-00962-1

32. Bohlin G, Hagekull B. Socio-emotional development: from infancy to young adulthood. *Scand J Psychol.* (2009) 50:592–601. doi: 10.1111/j.1467-9450.2009.00787.x

33. Crozier WR, Badawood A. Shyness, vocabulary and children's reticence in Saudi Arabian preschools. *Infant Child Dev.* (2009) 18:255–70. doi: 10.1002/icd.623

34. Van Kleeck A, Street R. Does reticence mean just talking less? Qualitative differences in the language of talkative and reticent preschoolers. *J Psycholinguist Res.* (1982) 11:609–29. doi: 10.1007/BF01067615

35. Coplan RJ, Evans MA. At a loss for words? Introduction to the special issue on shyness and language in childhood. *Infant Child Dev.* (2009) 18:211–5. doi: 10.1002/icd.620

36. Smith Watts AK, Patel D, Corley RP, Friedman NP, Hewitt JK, Robinson JL, et al. Testing alternative hypotheses regarding the association between behavioral inhibition and language development in toddlerhood. *Child Dev.* (2014) 85:1569–85. doi: 10.1111/cdev.12219

37. Coplan RJ, Wichmann C, Lagacé-Séguin DG. Solitary-active play behavior: a marker variable for maladjustment in the preschool? *J Res Child Educ.* (2001) 15:164–72. doi: 10.1080/02568540109594957

38. Findlay LC, Coplan RJ. Come out and play: shyness in childhood and the benefits of organized sports participation. *Can J Behav Sci.* (2008) 40:153–61. doi: 10.1037/0008-400X.40.3.153

39. Karevold EB, Coplan RJ, Stoolmiller M, Mathiesen KS. A longitudinal study of the links between temperamental shyness, activity, and trajectories of internalising problems from infancy to middle childhood. *Aust J Psychol.* (2011) 63:36–43. doi: 10.1111/j.1742-9536.2011.00005.x

40. Thorell L, Bohlin G, Rydell AM. Two types of inhibitory control: predictive relations to social functioning. *Int J Behav Dev.* (2004) 28:193–203. doi: 10.1080/01650250344000389

41. Brooker RJ, Kiel EJ, Buss KA. Early social fear predicts kindergarteners' socially anxious behaviors: direct associations, moderation by inhibitory control, and differences from nonsocial fear. *Emotion.* (2016) 16:997–1010. doi: 10.1037/emo0000135

42. Coplan RJ, Armer M. Talking yourself out of being shy: shyness, expressive vocabulary, and socioemotional adjustment in preschool. *Merrill Palmer Q.* (2005) 51:20–41. doi: 10.1353/mpq.2005.0004

43. Baardstu S, Coplan RJ, Eliassen E, Brandlistuen RE, Wang MV. Exploring the role of teacher–child relationships in the longitudinal associations between childhood shyness and social functioning at school: a prospective cohort study. *School Ment Health.* (2022) 14:984–96. doi: 10.1007/s12310-022-09518-1

44. Sette S, Zava F, Baumgartner E, Laghi F, Coplan RJ. Exploring the role of play behaviors in the links between preschoolers' shyness and teacher-child relationships. *Early Educ Dev.* (2022) 33:187–203. doi: 10.1080/10409289.2021.1885237

45. Doey L, Coplan RJ, Kingsbury M. Bashful boys and coy girls: a review of gender differences in childhood shyness. *Sex Roles.* (2014) 70:255–66. doi: 10.1007/s11199-013-0317-9

46. Kopala-Sibley DC, Klein DN. Distinguishing types of social withdrawal in children: internalizing and externalizing outcomes of conflicted shyness versus social disinterest across childhood. *J Res Pers.* (2017) 67:27–35. doi: 10.1016/j.jrp.2016.01.003

47. Schwartz CE, Snidman N, Kagan J. Adolescent social anxiety as an outcome of inhibited temperament in childhood. *J Am Acad Child Adolesc Psychiatry.* (1999) 38:1008–15. doi: 10.1097/00004583-199908000-00017

48. Bekkhus M, McVarnock A, Coplan RJ, Ulset V, Kraft B. Developmental changes in the structure of shyness and internalizing symptoms from early to middle childhood: a network analysis. *PsyArXiv* [Preprint]. (2022):doi: 10.31234/osf.io/9m68s

49. Letourneau NL, Duffett-Leger L, Levac L, Watson B, Young-Morris C. Socioeconomic status and child development: a meta-analysis. *J Emot Behav Disord.* (2011) 21:211–24. doi: 10.1177/1063426611421007

50. Alexandersen N, Zachrisson HD, Wilhelmsen T, Wang MV, Brandlistuen RE. Predicting selection into ECEC of higher quality in a universal context: the role of parental education and income. *Early Child Res Q.* (2021) 55:336–48. doi: 10.1016/j.ecresq.2021.01.001

51. Magnus P, Irgens LM, Haug K, Nystad W, Skjærven R, Stoltenberg C, et al. Cohort profile: the Norwegian mother and child cohort study (MoBa). *Int J Epidemiol.* (2006) 35:1146–50. doi: 10.1093/ije/dyl170

52. Magnus P, Birke C, Vejrup K, Haugan A, Alsaker E, Daltveit AK, et al. Cohort profile update: the Norwegian mother and child cohort study (MoBa). *Int J Epidemiol.* (2016) 45:382–8. doi: 10.1093/ije/dyw029

53. Irgens LM. The medical birth registry of Norway. Epidemiological research and surveillance throughout 30 years. *Acta Obstet Gynecol Scand.* (2000) 79:435–9. doi: 10.1034/j.1600-0412.2000.079006435.x

54. Norwegian Institute of Public Health. *Norwegian Mother, Father and Child Cohort Study (MoBa).* Oslo: Norwegian Institute of Public Health (2019).

55. Buss AH, Plomin R. *Temperament: Early Developing Personality Traits.* Hillsdale, NJ: Erlbaum (1984).

56. Walker KL, Ammaturo DA, Wright KD. Are we assessing temperament appropriately? The emotionality activity sociability and impulsivity (EASI) temperament scale: a systematic psychometric review. *Can Psychol.* (2017) 58:316–32. doi: 10.1037/cap0000108

57. Coplan RJ, Rubin KH. Exploring and assessing nonsocial play in the preschool: the development and validation of the preschool play behavior scale. *Soc Dev.* (1998) 7:72–91.

58. Kesäläinen J, Suhonen E, Alijoki A, Sajaniemi N. Children's play behaviour, cognitive skills and vocabulary in integrated early childhood special education groups. *Int J Inclusive Educ.* (2019) 26:1–17. doi: 10.1080/13603116.2019.1651410

59. Ho LC. Validation of preschool play behavior scale for korean preschool children (PPBS-K). *Life Sci Res.* (2021) 25:1–11. doi: 10.36357/johe.2021.25.3.1

60. Brandlistuen RE, Flatø M, Stoltenberg C, Helland SS, Wang MV. Gender gaps in preschool age: a study of behavior, neurodevelopment and pre-academic skills. *Scand J Public Health.* (2020) 49:1403494820944740. doi: 10.1177/1403494820944740

61. Choo MS, Xu Y, Haron PF. Subtypes of nonsocial play and psychosocial adjustment in Malaysian preschool children. *Soc Dev.* (2012) 21:294–312. doi: 10.1111/j.1467-9507.2011.00630.x

62. Aslan ÖM. Turkish and American preschoolers' play, aggression and victimization behaviours in play context. *Early Child Dev Care.* (2020) 190:348–63. doi: 10.1080/03004430.2018.1472088

63. Ireton H. *Child Development Inventory, Manual.* Minneapolis, MN: Behavior Science Systems (1992).

64. Chaffee CA, Cunningham CE, Secord-Gilbert M, Elbard H, Richards J. Screening effectiveness of the Minnesota child development inventory expressive and receptive language scales: sensitivity, specificity, and predictive value. *Psychol Assess.* (1990) 2:80–5. doi: 10.1037/1040-3590.2.1.80

65. Ottem E. Spørsmål om språkferdigheter: en analyse av sammenhengen mellom observasjonsdata og testdata. *Skolepsykologi.* (2009) 1:11–27.

66. Bishop DV. *The Children's Communication Checklist.* London: Psychological Corporation London (2003).

67. Hollund-Møllerhaug L. Children's communication checklist (CCC-2): en sammenligning av GCC-skårenes persentilfordeling i et britisk og norsk utvalg. *Tidsskrift Norsk Psykol.* (2010) 47:824–6.

68. Birmaher B, Khetarpal S, Brent D, Cully M, Balach L, Kaufman J, et al. The screen for child anxiety related emotional disorders (SCARED): scale construction and psychometric characteristics. *J Am Acad Child Adolesc Psychiatry.* (1997) 36:545–53. doi: 10.1097/00004583-199704000-00018

69. Birmaher B, Brent DA, Chiappetta L, Bridge J, Monga S, Baugher M. Psychometric properties of the screen for child anxiety related emotional disorders (SCARED): a replication study. *J Am Acad Child Adolesc Psychiatry.* (1999) 38:1230–6. doi: 10.1097/00004583-199910000-00011

70. Angold A, Costello EJ, Messer SC, Pickles A. Development of a short questionnaire for use in epidemiological studies of depression in children and adolescents. *Int J Methods Psychiatr Res.* (1995) 5:237–49.

71. Fernández-Martínez I, Morales A, Méndez FX, Espada JP, Orgilés M. Spanish adaptation and psychometric properties of the parent version of the short mood and feelings questionnaire (SMFQ-P) in a non-clinical sample of young school-aged children. *Span J Psychol.* (2020) 23:e45. doi: 10.1017/SJP.2020.47

72. Muthen L, Muthen B. *MPlus User's Guide.* 8th ed. Los Angeles, CA: Muthen & Muthen (2017).

73. Lodder P, Denollet J, Emons WHM, Nefs G, Pouwer F, Speight J, et al. Modeling interactions between latent variables in research on type D personality: a Monte Carlo simulation and clinical study of depression and anxiety. *Multivar Behav Res.* (2019) 54:637–65. doi: 10.1080/00273171.2018.1562863

74. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equ Model.* (1999) 6:1–55. doi: 10.1080/10705519909540118

75. Widaman KF, Ferrer E, Conger RD. Factorial invariance within longitudinal structural equation models: measuring the same construct across time. *Child Dev Perspect.* (2010) 4:10–8. doi: 10.1111/j.1750-8606.2009.00110.x

76. Klein A, Moosbrugger H. Maximum likelihood estimation of latent interaction effects with the LMS method. *Psychometrika.* (2000) 65:457–74. doi: 10.1007/BF02296338

77. Maslowsky J, Jager J, Hemken D. Estimating and interpreting latent variable interactions: a tutorial for applying the latent moderated structural equations method. *Int J Behav Dev.* (2015) 39:87–96. doi: 10.1177/0165025414552301

78. Hayes AF. Beyond baron and Kenny: statistical mediation analysis in the new millennium. *Commun Monogr.* (2009) 76:408–20. doi: 10.1080/03637750903310360

79. Rubin KH, Coplan RJ, Bowker JC. Social withdrawal in childhood. *Annu Rev Psychol.* (2009) 60:141–71. doi: 10.1146/annurev.psych.60.110707.163642

80. Rapee RM, Coplan RJ. Conceptual relations between anxiety disorder and fearful temperament. *New Direct Child Adolesc Dev.* (2010) 2010:17–31. doi: 10.1002/cd.260

81. Crozier WR, Perkins P. Shyness as a factor when assessing children. *Educ Psychol Pract.* (2002) 18:239–44. doi: 10.1080/0266736022000010267

82. Spere KA, Schmidt LA, Theall-Honey LA, Martin-Chang S. Expressive and receptive language skills of temperamentally shy preschoolers. *Infant Child Dev.* (2004) 13:123–33. doi: 10.1002/icd.345

83. Evans MA. Reticent primary grade children and their more talkative peers: verbal, nonverbal, and self-concept characteristics. *J Educ Psychol.* (1996) 88:739–49. doi: 10.1037/0022-0663.88.4.739

84. Eisenberg N, Eggum ND, Di Giunta L. Empathy-related responding: associations with prosocial behavior, aggression, and intergroup relations. *Soc Issues Policy Rev.* (2010) 4:143–80. doi: 10.1111/j.1751-2409.2010.01020.x

85. Weinstein N, Ryan RM. When helping helps: autonomous motivation for prosocial behavior and its influence on well-being for the helper and recipient. *J Pers Soc Psychol.* (2010) 98:222–44. doi: 10.1037/a0016984

86. Rubin KH, Burgess KB, Coplan RJ. Social withdrawal and shyness. In: Smith PK, Hart CH editors. *Blackwell Handbook of Childhood Social Development*. London: Blackwell (2004). p. 330–52.

87. Rubin KH, Barstead MG. Gender differences in child and adolescent social withdrawal: a commentary. *Sex Roles.* (2014) 70:274–84. doi: 10.1007/s11199-014-0357-9

88. Findlay LC, Coplan RJ, Bowker A. Keeping it all inside: shyness, internalizing coping strategies and socio-emotional adjustment in middle childhood. *Int J Behav Dev.* (2009) 33:47–54. doi: 10.1177/0165025408098017

89. Mathiesen KS, Tambs K. The EAS temperament questionnaire: factor structure, age trends, reliability, and stability in a Norwegian sample. *J Child Psychol Psychiatry.* (1999) 40:431–9. doi: 10.1111/1469-7610.00460

90. Biele G, Gustavson K, Czajkowski NO, Nilsen RM, Reichborn-Kjennerud T, Magnus PM, et al. Bias from self selection and loss to follow-up in prospective cohort studies. *Eur J Epidemiol.* (2019) 34:927–38. doi: 10.1007/s10654-019-00550-1

91. Vejrup K, Magnus P, Magnus M. Lost to follow-up in the Norwegian mother, father and child cohort study. *Paediatr Perinat Epidemiol.* (2022) 36:300–9. doi: 10.1111/ppe.12821

92. Hughes RA, Heron J, Sterne JAC, Tilling K. Accounting for missing data in statistical analyses: multiple imputation is not always the answer. *Int J Epidemiol.* (2019) 48:1294–304. doi: 10.1093/ije/dyz032

93. Xu Y, Farver JAM, Yu L, Zhang Z. Three types of shyness in Chinese children and the relation to effortful control. *J Pers Soc Psychol.* (2009) 97:1061–73. doi: 10.1037/a0016576

frontiers | Frontiers in Psychiatry

TYPE Brief Research Report
PUBLISHED 23 March 2023
DOI 10.3389/fpsyt.2023.1081989

OPEN ACCESS

EDITED BY
Louis A. Schmidt,
McMaster University,
Canada

REVIEWED BY
Melanie Zimmer-Gembeck,
Griffith University,
Australia
Xuechen Ding,
Shanghai Normal University,
China
Junsheng Liu,
East China Normal University,
China

*CORRESPONDENCE
Brett Laursen
✉ laursen@fau.edu

SPECIALTY SECTION
This article was submitted to
Public Mental Health,
a section of the journal
Frontiers in Psychiatry

RECEIVED 27 October 2022
ACCEPTED 07 March 2023
PUBLISHED 23 March 2023

CITATION
Katulis G, Kaniušonytė G and Laursen B (2023) Positive classroom climate buffers against increases in loneliness arising from shyness, rejection sensitivity and emotional reactivity. *Front. Psychiatry* 14:1081989. doi: 10.3389/fpsyt.2023.1081989

Positive classroom climate buffers against increases in loneliness arising from shyness, rejection sensitivity and emotional reactivity

Gintautas Katulis[1], Goda Kaniušonytė[1] and Brett Laursen[1,2]*

[1]Institute of Psychology, Mykolas Romeris University, Vilnius, Lithuania, [2]Department of Psychology, Florida Atlantic University, Fort Lauderdale, FL, United States

Loneliness is detrimental to well-being, particularly during the transition into and early years of adolescence when peer relations are ascendant. Shy and emotionally sensitive youth, who often spend considerable time alone, have known vulnerabilities to loneliness. Studies of young children suggest that a supportive classroom context may mitigate adjustment risks, reducing victimization and improving a sense of belonging. Herein we extend this work to older students, testing the hypothesis that a positive classroom climate protects temperamentally vulnerable children (i.e., those who are shy, emotionally reactive, or sensitive to rejection) from escalating levels of loneliness across the course of a school year. A community sample of 540 (277 boys, 263 girls) Lithuanian students in grades 5–7 (10–14years old) completed identical surveys twice, 4–5months apart. Self-reports assessed shyness, emotional reactivity, and rejection sensitivity, as well as perceived positive classroom climate and loneliness. Path analyses indicated that longitudinal associations from shyness, emotional reactivity, and rejection sensitivity to increased loneliness were mitigated by positive classroom climate. In each case, temperamental vulnerability anticipated greater loneliness for youth reporting low but not high positive classroom climate. The results held after accounting for several potential confounding variables. The findings have practical implications, suggesting that scholars and practitioners redouble efforts to improve classroom support, particularly for temperamentally vulnerable children who are at elevated risk for solitude, loneliness, and attendant mental health challenges.

KEYWORDS

loneliness, classroom climate, shyness, rejection sensitivity, emotional reactivity

1. Introduction

Youth are at special risk for loneliness during late childhood and early adolescence, when peer relations are ascendent (1) The debilitating nature of loneliness cannot be overstated: Lonely children and adolescents present a host of short- and long-term mental health problems (2). Not everyone is equally disposed to being lonely. Shy, sensitive to rejection, and emotionally reactive youth have temperamental vulnerabilities that place them at heightened risk for loneliness (3–5). Alert to these risks, investigators have focused on factors that might mitigate loneliness in vulnerable youth. Chief among them is classroom climate, which is known to buffer against adjustment difficulties among children with peer difficulties (6). Using a community sample of Lithuanian youth ages 10 to14, we test the hypotheses that perceived positive classroom climate

moderates longitudinal associations from temperamental vulnerabilities (i.e., shyness, emotional reactivity, and rejection sensitivity) to heightened loneliness.

Loneliness is a painful state of unwanted social isolation, often occurring in response to perceived relationship deficits (7, 8). Lonely children report higher rates of solitude and preference for solitude than their nonlonely counterparts (9), not because they enjoy being alone but rather typically to avoid social discomfort (10). Developmental changes conspire to make the transition into adolescence a period of heightened loneliness (1). By some estimates, up to 30% of youth report regularly feeling lonely or very lonely (11). Buffeted by uncertainties about identity, improved perspective taking abilities, and expectations for autonomy, opportunities for social isolation multiply as the social world is transformed from one constructed by adults to one dominated by peers. Lonely youth suffer, particularly from victimization and depression (12, 13).

Some youth have temperamental vulnerabilities that heighten their risk for loneliness. We focus here on children who present elevated levels of shyness, rejection sensitivity, or emotional reactivity, three risk factors with biological origins. *Shyness* is characterized by conflicting motivations to engage and avoid peers; interactions with agemates are appealing but concerns about negative evaluations can prompt distress and a desire to withdraw (14). *Rejection sensitivity* is a heightened tendency to "anxiously expect, readily perceive, and overreact" to social rejection (15). *Emotional reactivity* describes a heightened (often negative) emotional response to affective situations (16). Grounded in temperament, each manifests early in life and is relatively stable across development (17–19). Although modestly correlated [*rs* range from.300 to.450 (20–22)], the constructs are conceptually and empirically distinct. Shyness stems from a fear of novelty (17), rejection sensitivity has biopsychosocial origins associated with sensitive interpretation of ambiguous early social experiences (23), and emotional reactivity reflects a low emotional threshold for external stimuli (19).

Shy, reactive, and sensitive to rejection youth are assumed to be prone to loneliness because of two underlying mechanisms: An inclination to interpret social situations negatively and social inhibitions that interfere with the creation and maintenance of social ties (3, 24, 25). Solitude may be preferred to the uncertainties and potential pain of social engagement (26, 27), which heightens risks for loneliness (28). Many temperamentally vulnerable youth possess off-putting characteristics, a problem exacerbated by cascading social skills deficits brought on by minimal peer contact (29). A self-fulfilling prophecy unfolds whereby hypervigilance prompts negative interpretations or inaccurate interpretations of social cues and inappropriate emotional reactions to social situations, alienating peers who avoid them as unattractive interaction partners, forcing isolation and fostering loneliness. (30). Finally, temperamentally vulnerable children may find themselves with few friend options aside from other interpersonally challenged agemates, who may be equally unsatisfying partners (31, 32).

Consistent with the above, research indicates that temperamentally vulnerable children are at heightened risk for loneliness. The evidence for shyness is particularly compelling. Shy youth report feeling lonely more frequently than those who are not shy (5). Rejection sensitivity has also been linked to longitudinal increases in adolescent loneliness (4). Less is known about emotional reactivity. Longitudinal links between parent-reported negative reactivity and related constructs have been established. Specifically, among adolescents, emotional intelligence has been linked with loneliness (33) and emotional reactivity has been linked to emotional problems (34).

Our study starts from the premise that perceived support from classmates can help protect temperamentally vulnerable children against loneliness. Research based on social information processing mechanisms [predisposed emotional responses to social cues based on past experiences which impact the interpretation of the situation and the following behaviors] suggests that shy youth are less prone to interpret social situations in a self-defeating manner when interacting with supportive friends (35). Perceiving the classroom as supportive is the postulated mechanism through which the risk of loneliness is reduced. In supportive classes, vulnerable children may interpret social situations as pleasant, lowering the risk of loneliness as children reframe social experiences (36). Additionally, supportive classrooms have higher group cohesion and mutual respect, avoiding situations that elicit mismatched emotional responses that can lead to social exclusion (37). As a consequence, temperamentally vulnerable youth may feel comfortable engaging in interactions that lead to meaningful social connections (38). Additional social opportunities, in turn, help youth improve social skills in ways that diminish the tendency to withdraw (39).

Our study is novel in that we focus on perceptions of classroom climate as an index of support. Positive classroom climate is defined as the perceived tenor of the classroom and the degree to which students feel comfortable and at ease in the classroom and with classmates (40). Perceived classroom climate has been shown to moderate concurrent association between other biologically-linked traits (e.g., effortful control) and depressive symptoms (41). Longitudinal data from college students (42) and concurrent data from young adolescents (3) agree that friend support protects youth against loneliness arising from peer difficulties. Supportive classrooms should operate in a similar manner. For instance, two studies of indicate that school and classroom climate buffered against loneliness among victimized children and young adolescents (43, 44). Similarly, a 3-year study of primary school students indicated that anxious withdrawn children were less likely to be excluded in supportive classrooms than in unsupportive classrooms (37).

The present study utilizes a community sample of Lithuanian primary and middle school students to examine whether perceived positive classroom climate moderates longitudinal associations from shyness, emotional regulation, and rejection sensitivity to increases in loneliness across a four-month period during a single school year. We hypothesized that shyness, rejection sensitivity and emotional reactivity would predict increases in loneliness for youth who perceived low but not high levels of classroom support. Given that temperamental vulnerabilities may have different social outcomes depending on gender (e.g., shy girls face less rejection than shy boys) (45), we compared boys and girls on patterns of association. Because loneliness is associated with emotional problems (34) and the number and quality of friendships (41), each was included as a covariate in supplemental analyses. Victimization has been linked to perceived classroom climate (46) as well as shyness (47), emotional reactivity (48), and rejection sensitivity (49), so peer reports of relational and physical victimization were also included as potential confounders.

2. Methods

2.1. Participants

Participants included 540 students in 5th (97 boys, 89 girls; M_{age} = 10.85, SD_{age} = 0.410), 6th (84 boys, 81 girls; M_{age} = 11.83, SD_{age} = 0.437), and 7th (96 boys, 93 girls; M_{age} = 12.73, SD_{age} = 0.457) grades. Nearly all participants were of Lithuanian ethnicity. Most lived with two biological parents (69.3%); the remainder lived in blended (13.7%) or single parent (15.6%) households, or with guardians or grandparents (1.5%). Approximately 9.5% received free meals at school.

2.2. Procedure

All 5-7th graders (attending 33 classrooms in 4 middle schools) in the community were invited to participate. Written parent consent and student assent were required for participation. Trained research assistants administered questionnaires in classes on computer tablets in September 2021 and February 2022. The study was approved by the university ethics committee (Nr. 6/202).

The initial participation rate was 65.2%. Of the 540 students who participated at Time 1, 525 also participated at Time 2. There were no differences in any study or demographic variables between students who did and did not participate at both time points. Item-level missingness ranged from 3.3–22.6% (M = 11.7%, SD = 6.0). Little's MCAR test indicated that data were missing completely at random, $\chi^2(16{,}101) = 15{,}689.330$, $p = 0.990$. Item-level missing data were imputed with an EM algorithm with 25 iterations. Missing wave-level data were handled with FIML.

2.3. Measures

Participants completed the same surveys at both time points. Unless otherwise indicated, items were rated on a scale ranging from 1 (*strongly disagree*) to 5 (*Strongly agree*). Scores were averaged. Higher scores indicated greater levels of a variable. Internal reliabilities are presented in Table 1. All items for each variable are listed in Supplementary Table S1.

2.3.1. Shyness

Participants completed a 3-item shyness scale from the Motivations for Withdrawal Questionnaire (14) (e.g., "I am shy").

2.3.2. Perceived positive classroom climate

Participants completed a 3-item positive classroom climate scale adapted from the Peer Context Questionnaire (40) (e.g., "In this class, I feel comfortable").

2.3.3. Emotional reactivity

Participants completed a 5-item adapted version of emotional reactivity scale (50) (e.g., "My feelings get hurt easily").

2.3.4. Rejection sensitivity

Participants completed an abbreviated 6-item rejection sensitivity scale adapted from the Rejection Sensitivity Questionnaire (51) (e.g., "How nervous would you feel about whether anyone will choose you?"). Items were rated from 1 (*not worried at all*) to 5 (*very worried*). For each of 3 hypothetical social situations, responses to 2 questions were multiplied, then averaged.

2.3.5. Loneliness

Participants completed a 3-item adapted version of loneliness scale (52) (e.g., "I feel alone at school").

2.3.6. Potential confounding variables

To isolate effects to the main study variables, supplemental analyses were conducted that included, as Time 1 covariates and Time 2 predictors, variables known to correlate with loneliness, shyness, emotional reactivity, and/or rejection sensitivity. *Emotional problems*, previously linked to shyness and loneliness (53, 54), were measured with 6 items from the Strengths and Difficulties Questionnaire (55) (e.g., "I worry a lot"). Additionally, participants completed a peer assessment questionnaire consisting of a roster on which they identified classmates who best fit a description (56). Unlimited same and other sex nominations were permitted. Nominations received were summed and standardized within classes (57). Two measures of peer liking were included, previously linked to rejection sensitivity (58): (a) *rejection* ("someone you do not like to spend time with") and (b) *acceptance* ("someone you like to spend time with"). Two measures of peer victimization were included, previously linked to loneliness (59). (c) *relational victimization* ("Someone who is called names or teased by others") and (d) *physical victimization* ("someone who is hit or pushed by others"). Finally, the quantity and quality of friendships were assessed, previously linked to loneliness (6) and rejection sensitivity (60). Participants identified up to 5 friends, from which the *number of reciprocated friendships* (M = 1.90, SD = 1.52) was determined. For the first and second best friends, each participant completed an abbreviated version of the Network of Relationships Inventory (61), with 5 items describing *friendship social support* (e.g., "My friend and I help each other out") and 4 items describing *friendship negativity* (e.g., "My friend and I argue with each other"). Scores for the two best friends were averaged.

2.4. Plan of analysis

Analyses tested the hypothesis that perceived positive classroom climate moderates longitudinal associations from shyness, emotional reactivity, and rejection sensitivity to changes in adolescent loneliness. A two-step procedure for estimating moderated paths was conducted in Mplus 8.4. Figure 1 illustrates the analytic model. The model is akin to a residual change model, such that autoregressive effects represent the stability of a variable. By accounting for stability and within time correlations, cross-lagged paths predict residual change. The COMPLEX function was applied to address potential classroom-level differences; the same pattern of statistically significant results emerged without it, implying minimal variation across classes (56). Intraclass correlations between the main variables, calculated within classrooms, ranged from 0.004 to 0.043 suggesting that classroom nesting accounted for little to no variability (62). Standard model fit indices were applied (63). The chi-squared index should be nonsignificant; the root-mean-square error of approximation (RMSEA) should be 0.06 or lower; the Tucker-Lewis index (TLI) should be greater than 0.95 (64).

TABLE 1 Interclass correlations, means, and standard deviations.

Variable	1	2	3	4	5	*M* (SD)	*Cronbach's a*
1. Loneliness	543** [0.451, 0.624]	571** [0.494, 0.642]	0.453** [0.381, 0.515]	0.518** [0.434, 0.601]	−0.520** [−0.600, −0.434]	1.854 (0.982)	0.950
2. Shyness	0.589** [0.511, 0.654]	0.602** [0.528, 0.666]	0.385** [0.299, 0.462]	0.455** [0.373, 0.538]	−0.342** [−0.433, −0.351]	2.174 (1.032)	0.858
3. Emotional reactivity	0.424** [0.339, 0.495]	0.343** [0.249, 0.425]	0.543** [0.474, 0.607]	0.418** [0.343, 0.490]	−0.215** [−0.308, −0.111]	3.070 (0.869)	0.836
4. Rejection sensitivity	0.478** [0.390, 0.555]	0.444** [0.354, 0.517]	0.367** [0.287, 0.439]	0.574** [0.495, 0.648]	−0.357** [−0.455, −0.258]	6.902 (4.536)	0.730
5. Perceived positive classroom climate	−0.569** [−0.637, −0.483]	−0.402** [−0.489, −0.313]	−0.185** [−0.270, −0.079]	−0.357** [−0.443, −0.262]	0.628** [0.556, 0.695]	3.717 (0.879)	0.848
M (SD)	1.858 (0.994)	2.251 (1.014)	3.121 (0.845)	6.937 (4.449)	3.768 (0.8613)		
Cronbach's a	0.941	0.826	0.808	0.672	0.795		

$N = 540$. Time 1 concurrent correlations are shown below the diagonal. Time 2 concurrent correlations are shown above the diagonal. Autocorrelations are presented on the diagonal. 95% confidence intervals in brackets.
*$p < 0.05$; **$p < 0.01$.

In the first step, a model (Model 0) without any interaction terms was estimated. Model 0 was trimmed by removing nonsignificant cross-lagged paths, provided that doing so did not worsen model fit (64).

In the second step, interaction terms (all measured at Time 1) were added to the model (Model 1). Three moderated models were tested in separate analyses: (1) Shyness predicting changes in loneliness moderated by perceived positive classroom climate (Model 1A); (2) Emotional reactivity predicting changes in loneliness moderated by perceived positive classroom climate (Model 1B); and (3) Rejection sensitivity predicting changes in loneliness moderated by perceived positive classroom climate (Model 1C).

In all models, grade in school was included as a Time 1 covariate to account for mean level differences (see below); the same pattern of statistically significant results emerged when grade was omitted.

Follow-up simple slope analyses probed statistically significant moderated associations at high (1 *SD* above the mean) and low (1 *SD* below the mean) levels of the moderator. The procedure estimates slopes at given levels of the predictor, utilizing the entire sample (65).

3. Results

3.1. Preliminary analysis

Table 1 presents interclass correlations (Pearson's *r*). At both time points, shyness, rejection sensitivity, emotional reactivity and loneliness were positively correlated with each other and negatively correlated with perceived positive classroom climate.

Separate 2 (gender) × 3 (grade) ANOVAs were conducted for each study variable, with time as a repeated measure. Statistically significant ($p < 0.05$) main effects of gender emerged for shyness [F (1)=21.055, $d = 0.402$], emotional reactivity [F (1)=71.757, $d = 0.742$], rejection sensitivity [F (1)=27.160, $d = 0.454$], and loneliness [F (1)=18.104, $d = 0.375$]. In each case, girls scored higher than boys. Statistically significant gender [F (1)=12.212, $d = 0.306$] and time [F (1)=4.262, $d = 0.179$] main effects on perceived positive classroom climate were qualified by a gender x time interaction [F (1)=5.030, $p = 0.025$]. Follow-up t-tests revealed that boys reported decreases in perceived positive classroom climate [F (1)=10.196, $d = 0.392$], whereas girls did not [F (1)=0.027, $d = 0.000$]. There was a grade x time interaction for loneliness [F (2)=3.676, $p = 0.026$]. Loneliness increased among 7th graders [F (1)=4.945, $d = 0.326$], but not among 5th [F (1)=2.749, $d = 0.246$] or 6th [F (1)=0.004, $d = 0.001$] graders.

3.2. Longitudinal associations from initial shyness, rejection sensitivity, and emotional reactivity to subsequent loneliness moderated by initial perceived positive classroom climate

3.2.1. Shyness, rejection sensitivity, and emotional reactivity predicting changes In loneliness

3.2.1 A trimmed version of Model 0 (without interaction terms) fit the data. Five nonsignificant paths were trimmed from the model: Time 1 perceived positive classroom comfort predicting Time 2 shyness (β = 0.029), emotional reactivity (β = −0.044) and rejection sensitivity (β = −0.042); and Time 1 emotional reactivity predicting Time 2 shyness (β = 0.060) and perceived positive classroom climate (β = −0.017). Results are presented in Table 2.

We focus first on the longitudinal paths of interest. There were positive associations from Time 1 shyness, Time 1 rejection sensitivity and Time 1 emotional reactivity to Time 2 loneliness. There also was a negative association from Time 1 perceived positive classroom climate to Time 2 loneliness.

Several additional cross-lagged paths were statistically significant. Time 1 rejection sensitivity was negatively associated with Time 2 perceived positive classroom climate, and positively associated with Time 2 emotional reactivity and Time 2 shyness. Time 1 shyness was positively associated with Time 2 emotional reactivity and Time 2 rejection sensitivity, and negatively associated with Time 2 perceived positive classroom climate. Time 1 emotional reactivity was positively associated with Time 2 rejection sensitivity. All stability coefficients were statistically significant.

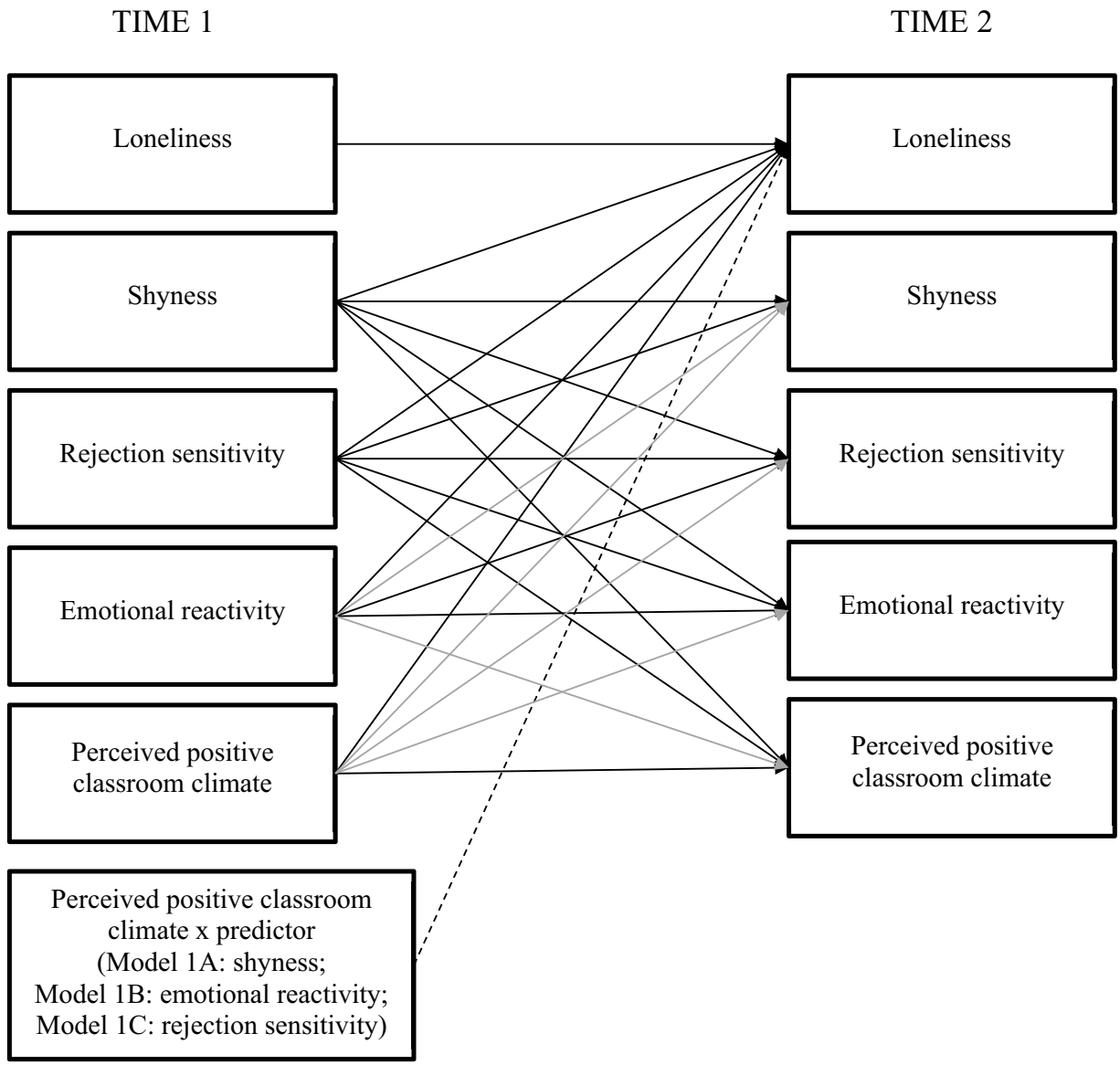


FIGURE 1
Longitudinal associations from shyness, rejection sensitivity, and emotional reactivity to loneliness: Direct and moderated analytic models. Gray lines represent nonsignificant paths that were trimmed from the final models. Solid lines represent paths that were included in Model 0 and Model 1; the dashed line represents one of three moderator variable paths that were separately included in Models 1A, 1B, and 1C. Concurrent correlations (not depicted) are given in Table 1.

3.2.2. Shyness predicting changes in loneliness, moderated by perceived positive classroom climate

Model 1A (with the shyness x perceived positive classroom climate interaction term) fit the data. The interaction term predicted changes in loneliness from Time 1 to Time 2. Figure 2 presents results from simple slope analyses. There was a significant positive association from Time 1 shyness to Time 2 loneliness at low (−1 *SD*) but not high (+1 *SD*) levels of perceived positive classroom climate. For youth reporting low perceived positive classroom climate, higher initial shyness was associated with increased loneliness across the school year.

3.2.3. Emotional reactivity predicting changes in loneliness, moderated by perceived positive classroom climate

Model 1B (with the emotional reactivity x perceived positive classroom climate interaction term) fit the data. The interaction term predicted changes in loneliness from Time 1 to Time 2. Figure 2 presents results from simple slope analyses. There was a significant positive association from Time 1 emotional reactivity to Time 2 loneliness at low (−1 *SD*) but not high (+1 *SD*) levels of perceived positive classroom climate. For youth reporting low perceived positive classroom climate, higher initial emotional reactivity was associated with increased loneliness across the school year.

TABLE 2 Longitudinal associations from Time1 shyness, emotional reactivity, rejection sensitivity to Time 2 loneliness moderated by Time 1 perceived classroom climate: Results from path analysis.

Longitudinal path	β	CI [95%]	*p*
Cross lagged paths (Model 0)			
T1 Emotional reactivity → T2 Loneliness	0.093**	[0.024, 0.162]	0.008
T1 Shyness → T2 Loneliness	0.101*	[0.015, 0.187]	0.021
T1 Classroom climate → T2 Loneliness	−0.13**	[−0.203, −0.057]	0.001
T1 Rejection sensitivity → T2 Loneliness	0.125**	[0.042, 0.208]	0.003
T1 Shyness → T2 Classroom climate	−0.077*	[−0.152, −0.001]	0.046
T1 Rejection sensitivity → T2 Classroom climate	−0.127**	[−0.201, −0.052]	0.001
T1 Shyness → T2 Emotional reactivity	0.117**	[0.037, 0.197]	0.004
T1 Rejection sensitivity → T2 Emotional reactivity	0.108*	[0.026, 0.189]	0.010
T1 Rejection sensitivity → T2 Shyness	0.129**	[0.053, 0.205]	0.001
T1 Emotional reactivity → T2 Rejection sensitivity	0.095*	[0.022, 0.168]	0.011
T1 Shyness → T2 Rejection sensitivity	0.145**	[0.068, 0.202]	0.001
Autoregressive paths (Model 0)			
T1 Loneliness → T2 Loneliness	0.289**	[0.204, 0.374]	0.000
T1 Shyness → T2 Shyness	0.545**	[0.479, 0.611]	0.000
T1 Rejection sensitivity → T2 Rejection sensitivity	0.479**	[0.407, 0.551]	0.000
T1 Emotional reactivity → T2 Emotional reactivity	0.459**	[0.389, 0.530]	0.000
T1 Classroom climate → T2 Classroom climate	0.554**	[0.491, 0.617]	0.000
Model 1A			
T1 Shyness × T1 Classroom climate → T2 Loneliness	−0.364**	[−0.563, −0.166]	0.001
Model 1B			
T1 Emotional reactivity × T1 Classroom climate → T2 Loneliness	−0.502**	[−0.784, −0.221]	0.011
Model 1C			
T1 Rejection sensitivity × T1 Classroom climate → T2 Loneliness	−0.420**	[−0.614, −0.226]	0.000

$N = 540$. Standardized beta weights reported. Model 0 describes results without interaction terms. Models 1 (ABC) describe results from separate models that included interaction terms. Nonsignificant paths were trimmed. Concurrent correlations are given in Table 1. Model fit the data for model 0 [$\chi^2(14) = 15.541$, $p = 0.342$; TLI = 0.997; RMSEA = 0.014 (0.000, 0.045)], Model 1A [$\chi^2(18) = 24.890$, $p = 0.127$; TLI = 0.987; RMSEA = 0.027 (0.000, 0.050)], Model 1B [$\chi^2(18) = 26.350$, $p = 0.092$; TLI = 0.984; RMSEA = 0.029 (0.000, 0.052), and Model 1C [$\chi^2(18) = 26.974$, $p = 0.080$; TLI = 0.983; RMSEA = 0.003 (0.000, 0.053)]. Classroom climate = Positive perceived classroom climate.
*$p < 0.05$; **$p < 0.01$.

3.2.4. Rejection sensitivity predicting changes in loneliness, moderated by perceived positive classroom climate

Model 1C (with the rejection sensitivity x perceived positive classroom climate interaction term) fit the data. The interaction term predicted changes in loneliness from Time 1 to Time 2. Figure 2 presents results from simple slope analyses. There was a significant positive association from Time 1 rejection sensitivity to Time 2 loneliness at low (−1 *SD*) but not high (+1 *SD*) levels of perceived positive classroom climate. For youth reporting low perceived positive classroom climate, higher initial rejection sensitivity was associated with increased loneliness across the school year.

3.2.5. Supplemental analyses

Additional analyses were conducted to rule out the possibility that associations were driven by unobserved variables previously linked to the predictor, moderator, and dependent variables. With one exception, the same pattern of statistically significant results emerged when potential confounding variables (i.e., gender, self-reports of emotional problems, number of reciprocated friendships, friendship social support, friendship negativity, peer reports of relational victimization and physical victimization, and peer reports of rejection and acceptance) were separately included as Time 1 covariates and as predictors of Time 2 outcomes. When emotional problems were included in the model 0, the Time 1 shyness to Time 2 loneliness path became marginally significant (β = 0.080; $p = 0.085$).

Multiple group contrasts identified only one gender difference in cross-lagged associations ($\Delta\chi^2 = 8.92$, $p = 0.002$): Time 1 rejection sensitivity was positively associated with Time 2 loneliness for boys (β = 0.051, $p = 0.001$) but not for girls (β = 0.011, $p = 0.341$).

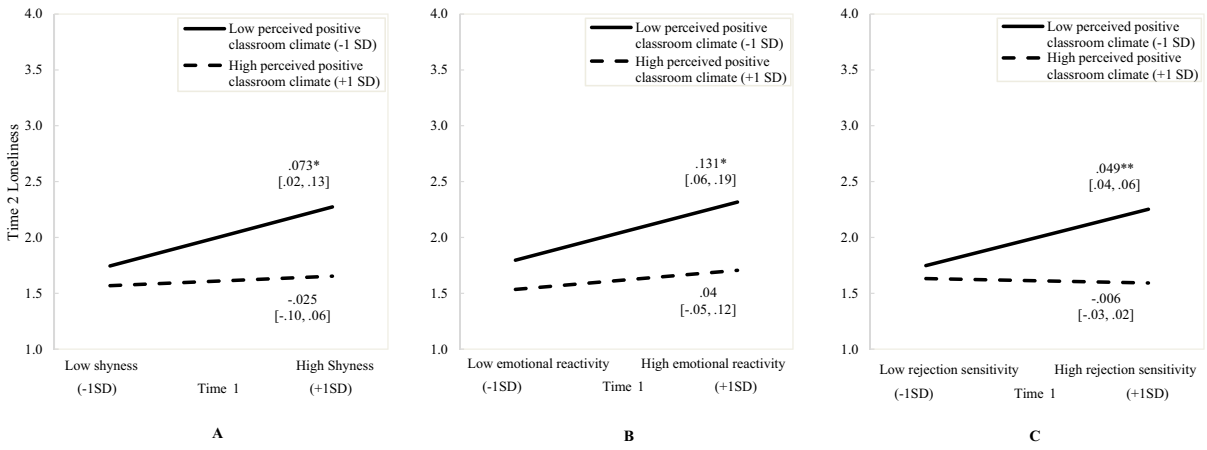


FIGURE 2
Time 1 Shyness **(A)**, Emotional reactivity **(B)** and Rejection sensitivity **(C)** predicting Time 2 Loneliness at low and high levels of perceived positive classroom climate. *N*=540; * *p*<0.05; ** *p*<0.001.

4. Discussion

We followed a community sample of pre- and early adolescents over the course of a single school year to examine the mitigating role of perceived positive school climate in the development of loneliness among temperamentally vulnerable (i.e., shy, sensitive to rejection, or emotionally reactive) children. The results indicated that perceived positive classroom climate moderates longitudinal associations. In each case, temperamental vulnerabilities anticipated greater loneliness for youth reporting low but not high positive classroom climate.

The findings replicate and extend insights into the antecedents of loneliness. In terms of replication, the findings add to the long list of studies indicating that shy children are especially vulnerable to loneliness (5). Others have also reported that rejection sensitivity increases loneliness (25). Far fewer longitudinal studies have examined whether emotionally reactive children are similarly at risk (3). Taken together with results from previous research, our findings underscore the painful and potentially debilitating costs of loneliness that confront emotionally vulnerable children.

We are not the first to find that a positive classroom climate buffers against conditions that might otherwise have an adverse impact on development. Perceptions of classroom support protect against the untoward consequences of victimization (46, 66), and mitigate the effects of low effortful control on conduct problems (67) and depressive symptoms (36). As such, the findings align with social information processing theory (35), which posits that temperamentally vulnerable youth in classrooms perceived as supportive tend to interpret challenging social situations as benign and nonthreatening. Different processes may be at work depending on whether risks for loneliness have origins in overly sensitive perceptions of social situations (3) or relationship difficulties caused by unattractive traits (31, 32). Shy and sensitive youth may perceive supportive classrooms as a safe place where temperamental characteristics are not a social liability, providing confidence to build ties with classmates. Supportive classrooms are characterized by high engagement and positive peer and teacher interactions (68). Teachers and classmates may work to minimize the time the emotionally vulnerable spend alone and avoid activities that exclude or marginalize members. Finally, supportive classrooms are known to embrace prosocial norms (43), which may disrupt the self-fulfilling prophecy cycle among sensitive children or counteract incipient loneliness among youth so inclined.

Classroom climate has a downstream influence on solitude. Start from the premise that perceptions of a positive classroom climate are joined with perceptions of positive peer experiences (69). Children and adolescents who enjoy spending time with classmates may leap at opportunities to spend time together out of class, accepting and making social invitations, and enrolling in clubs and after-school activities. Additional social experiences may provide temperamentally vulnerable children with much needed social skills practice, bolstering confidence in abilities and reducing withdrawal tendencies (39, 70). Unsupportive classrooms, in contrast, may increase the likelihood that shy and emotionally sensitive children seek to be alone when out of school (37). Discouraged by interpersonal missteps and fearful of replicating painful peer experiences, temperamentally vulnerable children may learn that solitude is safer and preferable (27). In the process, children who most need the company of others instead fall further behind in social skills, developing a (sometimes well-deserved) reputation for awkwardness, which can make successful social integration more difficult in the future.

Other replicated results should bolster confidence in our novel findings. Consistent with previous reports (21, 71), shyness, emotional reactivity, and rejection sensitivity were interrelated longitudinally, such that higher levels of one begat increases in another. We also found that shy and rejection sensitive children were least likely to report that classroom climate improved over the course of the school year, recalling findings from other studies in which less empathetic children (who are lower in emotion regulation) and children with more behavioral problems perceived declining levels of school climate (72, 73).

Our study is not without limitations. First, reliance on self-report variables increases the risk of bias arising from shared-reporter variance. This problem lacks an easy solution, however, because many of the variables of interest focus on child feelings and perceptions, which are not reliably gaged by teachers or parents (74) and whose impact may vary as a function of the discrepancy between actual and ideal self-perceptions (75). Observational data could help distinguish between the impact of perceived and actual classroom climate. Second, it was not possible, with two waves of data, to conduct a random intercept model. In its absence, conclusions about within-individual cross-lagged associations must be tempered, because

changes in loneliness may be a product of between-person effects (76). Person-oriented analyses may be better suited to identifying constellations of interpersonal and individual factors tied to adaptive and maladaptive outcomes (77). Third, perceived positive classroom climate is tied to the child's perceptions of relationships with friends and teachers (78, 79). The same pattern of results emerged when we controlled for friendship quality, suggesting that classroom climate captures more than just getting along with friends. Unfortunately, we lacked data on teacher-child relationships and so cannot make conclusions about the degree to which climate is distinct from getting along with teachers. Finally, the participants lived in a small, homogeneous Northern European community. Those unfamiliar with Lithuania may be hesitant to generalize from its populace. Once involuntarily situated in the Soviet Union, Lithuania is currently a member of the European Union. Students in Lithuania resemble those in other Western European nations with regard to adolescent norms, values, and development (80). Of course, it remains to be seen whether findings from this sample generalize to other, dissimilar contexts.

The results emphasize the importance of perceptions of classroom climate for the well-being of temperamentally vulnerable youth. Future research could investigate the processes through which positive classroom climate protects vulnerable adolescents (67) or classroom level characteristics which determine it being perceived as positive by vulnerable youth (37). This research has implications for classroom oriented interventions that extend well beyond loneliness, with the potential to change the lives of many youths who might otherwise develop a snowballing cascade of interpersonal and mental health challenges.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Mykolas Romeris University, Institute of Psychology, Committee of Psychological Research Ethics. DECISION Nr. 6/−202. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

Funding

This project has received funding from European Social Fund (project no 09.3.3-LMT-K-712-17-0009) under grant agreement with the Research Council of Lithuania (LMTLT).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2023.1081989/full#supplementary-material

References

1. Laursen B, Hartl AC. Understanding loneliness during adolescence: developmental changes that increase the risk of perceived social isolation. *J Adolesc*. (2013) 36:1261–8. doi: 10.1016/j.adolescence.2013.06.003

2. Loades ME, Chatburn E, Higson-Sweeney N, Reynolds S, Shafran R, Brigden A, et al. Rapid systematic review: the impact of social isolation and loneliness on the mental health of children and adolescents in the context of COVID-19. *J Am Acad Child Adolesc Psychiatry*. (2020) 59:1218–1239.e3. doi: 10.1016/j.jaac.2020.05.009

3. Qualter P, Brown SL, Rotenberg KJ, Vanhalst J, Harris RA, Goossens L, et al. Trajectories of loneliness during childhood and adolescence: predictors and health outcomes. *J Adolesc*. (2013) 36:1283–93. doi: 10.1016/j.adolescence.2013.01.005

4. Zhou J, Li X, Tian L, Huebner ES. Longitudinal association between low self-esteem and depression in early adolescents: the role of rejection sensitivity and loneliness. *Psychol Psychother Theory Res Pract*. (2020) 93:54–71. doi: 10.1111/papt.12207

5. Mahon NE, Yarcheski A, Yarcheski TJ, Cannella BL, Hanks MM. A meta-analytic study of predictors for loneliness during adolescence. *Nurs Res*. (2006) 55:308–15. doi: 10.1097/00006199-200609000-00003

6. Clark KN, Strissel D, Demaray MK, Ogg J, Eldridge MA, Malecki CK. Victimization and depressive symptoms in early adolescence: the role of perceived school climate. *Sch Psychol*. (2022) 37:355–66. doi: 10.1037/spq0000511

7. Perlman D, Peplau LA. Toward a social psychology of loneliness. *Pers Relat*. (1981) 3:31–56.

8. Kaniušonytė G, Truskauskaitė-Kunevičienė I, Žukauskienė R, Crocetti E. Knowing who you are for not feeling lonely? A longitudinal study on identity and loneliness. *Child Dev*. (2019) 90:1579–88. doi: 10.1111/cdev.13294

9. Goossens L, Lasgaard M, Luyckx K, Vanhalst J, Mathias S, Masy E. Loneliness and solitude in adolescence: a confirmatory factor analysis of alternative models. *Pers Individ Dif*. (2009) 47:890–4. doi: 10.1016/j.paid.2009.07.011

10. Corsano P, Grazia V, Molinari L. Solitude and loneliness profiles in early adolescents: a person-centred approach. *J Child Fam Stud*. (2019) 28:3374–84. doi: 10.1007/s10826-019-01518-1

11. Twenge JM, Haidt J, Blake AB, McAllister C, Lemon H, Le Roy A. Worldwide increases in adolescent loneliness. *J Adolesc*. (2021) 93:257–9. doi: 10.1016/j.adolescence.2021.06.006

12. Acquah EO, Topalli PZ, Wilson ML, Junttila N, Niemi PM. Adolescent loneliness and social anxiety as predictors of bullying victimisation. *Int J Adolesc Youth*. (2016) 21:320–31. doi: 10.1080/02673843.2015.1083449

13. Vanhalst J, Luyckx K, Teppers E, Goossens L. Disentangling the longitudinal relation between loneliness and depressive symptoms: prospective effects and the

intervening role of coping. *J Soc Clin Psychol*. (2012) 31:810–4. doi: 10.1521/jscp.2012.31.8.810

14. Barstead MG, Smith KA, Laursen B, Booth-LaForce C, King S, Rubin KH. Shyness, preference for solitude, and adolescent internalizing: the roles of maternal, paternal, and best-friend support. *J Res Adolesc*. (2018) 28:488–4. doi: 10.1111/jora.12350

15. Downey G, Feldman S. Implications of rejection sensitivity for intimate relationships. *J Pers Soc Psychol*. (1996) 70:1327–43. doi: 10.1037/0022-3514.70.6.1327

16. Silvers JA, McRae K, Gabrieli JD, Gross JJ, Remy KA, Ochsner KN. Age-related differences in emotional reactivity, regulation, and rejection sensitivity in adolescence. *Emotion*. (2012) 12:1235–47. doi: 10.1037/a0028297

17. Chen X. Culture and shyness in childhood and adolescence. *New Ideas Psych*. (2019) 53:58–66. doi: 10.1016/j.newideapsych.2018.04.007

18. Gao S, Assink M, Cipriani A, Lin K. Associations between rejection sensitivity and mental health outcomes: a meta-analytic review. *Clin Psychol Rev*. (2017) 57:59–74. doi: 10.1016/j.cpr.2017.08.007

19. Carlo G, Crockett LJ, Wolff JM, Beal SJ. The role of emotional reactivity, self-regulation, and puberty in adolescents' prosocial behaviors. *Soc Dev*. (2012) 21:667–5. doi: 10.1111/j.1467-9507.2012.00660.x

20. Wang Y, Chung MC. Linking rejection sensitivity, shyness and unsociability with posttraumatic stress disorder and psychiatric co-morbidity among Chinese adolescents. *Psych Q*. (2020) 91:309–9. doi: 10.1007/s11126-019-09701-9

21. Hassan R, Willoughby T, Schmidt LA. Development of shyness across adolescence: reactivity, regulation, or both? *Dev Psychol*. (2021) 57:421–31. doi: 10.1037/dev0001159

22. Preti E, Casini E, Richetin J, De Panfilis C, Fontana A. Cognitive and emotional components of rejection sensitivity: independent contributions to adolescent self-and interpersonal functioning. *Assessment*. (2020) 27:1230–41. doi: 10.1177/1073191118817866

23. Romero-Canyas R, Downey G, Berenson K, Ayduk O, Kang NJ. Rejection sensitivity and the rejection–hostility link in romantic relationships. *J Pers*. (2010) 78:119–8. doi: 10.1111/j.1467-6494.2009.00611.x

24. Zhao J, Song F, Chen Q, Li M, Wang Y, Kong F. Linking shyness to loneliness in Chinese adolescents: the mediating role of core self-evaluation and social support. *Pers Ind Diff*. (2018) 125:140–4. doi: 10.1016/j.paid.2018.01.007

25. London B, Downey G, Bonica C, Paltin I. Social causes and consequences of rejection sensitivity. *J Res Adolesc*. (2007) 17:481–6. doi: 10.1111/j.1532-7795.2007.00531.x

26. Wang JM, Rubin KH, Laursen B, Booth-LaForce C, Rose-Krasnor L. Preference-for-solitude and adjustment difficulties in early and late adolescence. *J Clin Child Adolesc Psychol*. (2013) 42:834–2. doi: 10.1080/15374416.2013.794700

27. Coplan RJ, Bowker JC, Nelson LJ. Alone again: revisiting psychological perspectives on solitude In: RJ Coplan, JC Bowker and LJ Nelson, editors. *The Handbook of Solitude: Psychological Perspectives on Social Isolation, Social Withdrawal, and Being Alone*. New York: John Wiley & Sons, Inc (2021)

28. Molinari L, Grazia V, Corsano P. School relations and solitude in early adolescence: a mediation model involving rejection sensitivity. *J Early Adolesc*. (2020) 40:426–8. doi: 10.1177/0272431619847523

29. Wang JM, Hartl AC, Laursen B, Rubin KH. The high costs of low agreeableness: low agreeableness exacerbates interpersonal consequences of rejection sensitivity in US and Chinese adolescents. *J Res Personal*. (2017) 67:36–43. doi: 10.1016/j.jrp.2016.02.005

30. Herd T, Kim-Spoon J. A systematic review of associations between adverse peer experiences and emotion regulation in adolescence. *Clin Child Fam Psychol Rev*. (2021) 24:141–3. doi: 10.1007/s10567-020-00337-x

31. Bowker JC, Thomas KK, Norman KE, Spencer SV. Mutual best friendship involvement, best friends' rejection sensitivity, and psychological maladaptation. *J Youth Adolesc*. (2011) 40:545–5. doi: 10.1007/s10964-010-9582-x

32. Rubin KH, Wojslawowicz JC, Rose-Krasnor L, Booth-LaForce C, Burgess KB. The best friendships of shy/withdrawn children: prevalence, stability, and relationship quality. *J Abnorm Child Psychol*. (2006) 34:139–3. doi: 10.1007/s10802-005-9017-4

33. Wols A, Scholte RH, Qualter P. Prospective associations between loneliness and emotional intelligence. *J Adolesc*. (2015) 39:40–8. doi: 10.1016/j.adolescence.2014.12.007

34. Dollar JM, Perry NB, Calkins SD, Shanahan L, Keane SP, Shriver L, et al. Longitudinal associations between specific types of emotional reactivity and psychological, physical health, and school adjustment. *Dev Psychopathol*. (2022) 17:1–5. doi: 10.1017/S0954579421001619

35. Burgess KB, Wojslawowicz JC, Rubin KH, Rose-Krasnor L, Booth-LaForce C. Social information processing and coping strategies of shy/withdrawn and aggressive children: does friendship matter? *Ch Dev*. (2006) 77:371–3. doi: 10.1111/j.1467-8624.2006.00876.x

36. Gazelle H. Class climate moderates peer relations and emotional adjustment in children with an early history of anxious solitude: a child× environment model. *Dev Psychol*. (2006) 42:1179–92. doi: 10.1037/0012-1649.42.6.1179

37. Avant TS, Gazelle H, Faldowski R. Classroom emotional climate as a moderator of anxious solitary children's longitudinal risk for peer exclusion: a child× environment model. *Dev Psychol*. (2011) 47:1711–27. doi: 10.1037/a0024021

38. Loukas A, Robinson S. Examining the moderating role of perceived school climate in early adolescent adjustment. *J Adolesc*. (2004) 14:209–3. doi: 10.1111/j.1532-7795.2004.01402004.x

39. Wang MT, Eccles JS. Social support matters: longitudinal effects of social support on three dimensions of school engagement from middle to high school. *Child Dev*. (2012) 83:877–5. doi: 10.1111/j.1467-8624.2012.01745.x

40. Boor-Klip HJ, Segers E, Hendrickx MM, Cillessen AH. Development and psychometric properties of the classroom peer context questionnaire. *Soc Dev*. (2016) 25:370–9. doi: 10.1111/sode.12137

41. Woods S, Done J, Kalsi H. Peer victimisation and internalising difficulties: the moderating role of friendship quality. *J Adolesc*. (2009) 32:293–8. doi: 10.1016/j.adolescence.2008.03.005

42. Tian Y, Chen P, Meng W, Zhan X, Wang J, Wang P, et al. Associations among shyness, interpersonal relationships, and loneliness in college freshmen: a longitudinal cross-lagged analysis. *Scand J Psychol*. (2019) 60:637–5. doi: 10.1111/sjop.12588

43. Schacter HL, Juvonen J. You've got a friend (ly school): can school prosocial norms and friends similarly protect victims from distress? *Soc Dev*. (2018) 27:636–1. doi: 10.1111/sode.12281

44. Troop-Gordon W, Chambless K, Brandt T. Peer victimization and well-being as a function of same-ethnicity classmates and classroom social norms: revisiting person× environment mismatch theory. *Dev Psychol*. (2021) 57:2050–66. doi: 10.1037/dev0001161

45. Doey L, Coplan RJ, Kingsbury M. Bashful boys and coy girls: a review of gender differences in childhood shyness. *Sex Roles*. (2014) 70:255–6. doi: 10.1007/s11199-013-0317-9

46. Sullivan K, Zhu Q, Wang C, Boyanton D. Relations among peer victimization, aggression, and school climate among elementary school students in China. *School Psych Rev*. (2021) 7:1–3. doi: 10.1080/2372966X.2021.1898290

47. Chen BB, Santo JB. The relationships between shyness and unsociability and peer difficulties: the moderating role of insecure attachment. *Int J Behav Dev*. (2016) 40:346–8. doi: 10.1177/0165025415587726

48. Rosen PJ, Milich R, Harris MJ. Dysregulated negative emotional reactivity as a predictor of chronic peer victimization in childhood. *Aggr Behav*. (2012) 38:414–7. doi: 10.1002/ab.21434

49. Zimmer-Gembeck MJ, Trevaskis S, Nesdale D, Downey GA. Relational victimization, loneliness and depressive symptoms: indirect associations via self and peer reports of rejection sensitivity. *J Youth Adolesc*. (2014) 43:568–2. doi: 10.1007/s10964-013-9993-6

50. Nock MK, Wedig MM, Holmberg EB, Hooley JM. The emotion reactivity scale: development, evaluation, and relation to self-injurious thoughts and behaviors. *Behav Ther*. (2008) 39:107–6. doi: 10.1016/j.beth.2007.05.005

51. Downey G, Lebolt A, Rincón C, Freitas AL. Rejection sensitivity and children's interpersonal difficulties. *Child Dev*. (1998) 69:1074–91. doi: 10.1111/j.1467-8624.1998.tb06161.x

52. Parker JG, Asher SR. Friendship and friendship quality in middle childhood: links with peer group acceptance and feelings of loneliness and social dissatisfaction. *Dev Psychol*. (1993) 29:611–21. doi: 10.1037/0012-1649.29.4.611

53. Lund I. 'I just sit there': shyness as an emotional and behavioural problem in school. *J Res Spec Educ Needs*. (2008) 8:78–87. doi: 10.1111/j.1471-3802.2008.00105.x

54. Schwartz-Mette RA, Shankman J, Dueweke AR, Borowski S, Rose AJ. Relations of friendship experiences with depressive symptoms and loneliness in childhood and adolescence: a meta-analytic review. *Psych Bulletin*. (2020) 146:664–700. doi: 10.1037/bul0000239

55. Goodman R. The strengths and difficulties questionnaire: a research note. *Child Psychol Psychiatry*. (1997) 38:581–6. doi: 10.1111/j.1469-7610.1997.tb01545.x

56. Yoho M, Faur S, Laursen B. Conflict moderates the longitudinal association between aggression with classmates and popularity: leveraging disagreements into peer status. *Pers Ind Diff*. (2022) 190:111538. doi: 10.1016/j.paid.2022.111538

57. Velásquez AM, Bukowski WM, Saldarriaga LM. Adjusting for group size effects in peer nomination data. *Soc Dev*. (2013) 22:845–3. doi: 10.1111/sode.12029

58. Wang J, McDonald KL, Rubin KH, Laursen B. Peer rejection as a social antecedent to rejection sensitivity in youth: the role of relational valuation. *Pers Ind Diff*. (2012) 53:939–2. doi: 10.1016/j.paid.2012.07.007

59. Storch EA, Brassard MR, Masia-Warner CL. The relationship of peer victimization to social anxiety and loneliness in adolescence. *Child Stud J*. (2003) 33:1–9.

60. McDonald KL, Bowker JC, Rubin KH, Laursen B, Duchene MS. Interactions between rejection sensitivity and supportive relationships in the prediction of adolescents' internalizing difficulties. *J Youth Adolesc*. (2010) 39:563–4. doi: 10.1007/s10964-010-9519-4

61. Furman W, Buhrmester D. Children's perceptions of the personal relationships in their social networks. *Dev Psychol*. (1985) 21:1016–24. doi: 10.1037/0012-1649.21.6.1016

62. Hedges LV, Hedberg EC. Intraclass correlation values for planning group-randomized trials in education. *Ed Eval Pol Anal*. (2007) 29:60–87. doi: 10.3102/0162373707299706

63. Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equ Modeling*. (1999) 6:1–55. doi: 10.1080/10705519909540118

64. Kline RB. *Principles and practice of structural equation modeling*. New York, Guilford publications: (2015).

65. Kaniušonytė G, Laursen B. Perceptions of positive parenting predict increases in resilience for low neurotic and high agreeable adolescents. *Pers Ind Diff*. (2022) 185:111272. doi: 10.1016/j.paid.2021.111272

66. Cava MJ, Musitu G, Buelga S, Murgui S. The relationships of family and classroom environments with peer relational victimization: an analysis of their gender differences. *Span J Psychol*. (2010) 13:156–5. doi: 10.1017/S1138741600003747

67. Loukas A, Murphy JL. Middle school student perceptions of school climate: examining protective functions on subsequent adjustment problems. *J Sch Psychol*. (2007) 45:293–309. doi: 10.1016/j.jsp.2006.10.001

68. Khalfaoui A, García-Carrión R, Villardón-Gallego L. A systematic review of the literature on aspects affecting positive classroom climate in multicultural early childhood education. *Early Child Educ J*. (2021) 49:71–81. doi: 10.1007/s10643-020-01054-4

69. Wang MT, Degol JL, Amemiya J, Parr A, Guo J. Classroom climate and children's academic and psychological wellbeing: a systematic review and meta-analysis. *Dev Rev*. (2020) 57:100912. doi: 10.1016/j.dr.2020.100912

70. Wentzel KA, Russell SR, Baker S. *Peer relationships and positive adjustment at school. In handbook of positive psychology in schools*. Milton Park: Routledge (2014).

71. Gardner AA, Zimmer-Gembeck MJ, Modecki K. A longitudinal model of rejection sensitivity and internalizing symptoms: testing emotion regulation deficits as a mechanism and outcome of symptoms. *J Pers*. (2020) 88:1045–57. doi: 10.1111/jopy.12549

72. Geukens F, Maes M, Cillessen AH, Colpin H, Van Leeuwen K, Verschueren K, et al. Spotting loneliness at school: associations between self-reports and teacher and peer nominations. *Int J Environ Res Public Health*. (2021) 18:971. doi: 10.3390/ijerph18030971

73. Ferguson GM, Hafen CA, Laursen B. Adolescent psychological and academic adjustment as a function of discrepancies between actual and ideal self-perceptions. *J Youth Adolesc*. (2010) 39:1485–97. doi: 10.1007/s10964-009-9461-5

74. Hamaker EL, Kuiper RM, Grasman RP. A critique of the cross-lagged panel model. *Psychol Methods*. (2015) 20:102–16. doi: 10.1037/a0038889

75. Hiatt C, Laursen B, Mooney KS, Rubin KH. Forms of friendship: a person-centered assessment of the quality, stability, and outcomes of different types of adolescent friends. *Pers Ind Diff*. (2015) 77:149–5. doi: 10.1016/j.paid.2014.12.051

76. Koth CW, Bradshaw CP, Leaf PJ. A multilevel study of predictors of student perceptions of school climate: the effect of classroom-level factors. *J Educ Psychol*. (2008) 100:96–104. doi: 10.1037/0022-0663.100.1.96

77. Nelson RM, DeBacker TK. Achievement motivation in adolescents: the role of peer climate and best friends. *J Exp Educ*. (2008) 76:170–9. doi: 10.3200/JEXE.76.2.170-190

78. Kaniušonytė G, Žukauskienė R. Relationships with parents, identity styles, and positive youth development during the transition from adolescence to emerging adulthood. *Emerg Adulthood*. (2018) 6:42–52. doi: 10.1177/216769681769097

79. Berg JK, Aber JL. A multilevel view of predictors of children's perceptions of school interpersonal climate. *J Educ Psychol*. (2015) 107:1150–70. doi: 10.1037/edu0000027

80. Way N, Reddy R, Rhodes J. Students' perceptions of school climate during the middle school years: associations with trajectories of psychological and behavioral adjustment. *Am J Community Psychol*. (2007) 40:194–3. doi: 10.1007/s10464-007-9143-y

frontiers | Frontiers in Psychiatry

TYPE Review
PUBLISHED 20 April 2023
DOI 10.3389/fpsyt.2023.1179677

OPEN ACCESS

EDITED BY
Junsheng Liu,
East China Normal University, China

REVIEWED BY
Xiaoyu Lan,
University of Oslo, Norway
Nejra van Zalk,
Imperial College London, United Kingdom

*CORRESPONDENCE
Alicia McVarnock
✉ aliciamcvarnock@cmail.carleton.ca

RECEIVED 04 March 2023
ACCEPTED 03 April 2023
PUBLISHED 20 April 2023

CITATION
McVarnock A, Cheng T, Polakova L and Coplan RJ (2023) Are you alone? Measuring solitude in childhood, adolescence, and emerging adulthood.
Front. Psychiatry 14:1179677.
doi: 10.3389/fpsyt.2023.1179677

Are you alone? Measuring solitude in childhood, adolescence, and emerging adulthood

Alicia McVarnock*, Tiffany Cheng, Laura Polakova and Robert J. Coplan

Department of Psychology, Carleton University, Ottawa, ON, Canada

The goal of this review was to provide an overview of how solitude has been operationally defined and measured since the year 2000 in psychological studies of children, adolescents, and emerging adults. After applying exclusionary criteria, our review of the extant literature identified *n*=19 empirical studies, which we grouped into three broad methodological categories: (1) experiments/manipulations (*n*=5); (2) retrospective reports (*n*=7); and (3) experience sampling measures (experience sampling methodology; *n*=7). A review of these studies indicated considerable variation in how solitude is operationalized and measured. There is also a notable lack of studies measuring solitude in childhood. Implications for 'what matters' when assessing solitude are discussed, and we provide a series of suggestions for helping this research area move forward.

KEYWORDS

solitude, time alone, childhood, adolescence, emerging adulthood, measuring solitude

Introduction

The study of solitude has a rich history in developmental psychology, with theoretical perspectives highlighting the potential costs and benefits of spending time alone. For example, excessive solitude has long been characterized as a cause of distress (1) and indicator of psychopathology (2). It was also commonly argued that because social connections are essential for healthy development and well-being, children spending frequent time alone are at increased risk of 'missing out' on benefits afforded by social interactions and relationships (3). Other perspectives have focused on the constructive role of solitary play for child development (4), solitary experiences as reprieve from social stresses (5), and the emergence of solitude as a domain for positive development in adolescence (6).

Many studies have explored the psychological aspects of solitude among children and youth over the last two decades, with a particular focus on the causes and consequences of time alone (22). The COVID-19 pandemic led to government-imposed containment strategies (e.g., lockdowns, social distancing), resulting in an overall increase in time spent alone (7). Such experiences have shone a brighter spotlight on the potential impacts of solitude on mental health and well-being in children, adolescents, and emerging adults (8). However, variations in how solitude is conceptualized, operationally defined, and measured have made it difficult to compare results across studies. Moreover, despite increased focus on aspects pertaining to the broad phenomenon of solitude (e.g., social withdrawal, peer exclusion, ostracism, loneliness, and aloneliness), few studies have assessed solitude itself. Accordingly, the goal of this review article was to provide an overview of how solitude has been operationally defined and measured since the year 2000 in psychological studies of children, adolescents, and emerging adults.

Conceptualizations of solitude

There has been considerable variation in the psychological conceptualizations of solitude. For example, a common (and seemingly objective) perspective considers solitude as a *physical* separation from others. In this regard, Goffman (9) described solitude using the metaphor of being 'off stage' and removed from perceived social expectations and demands. However, as has been previously noted, there is no consensus among researchers as to the required minimum physical distance from others for an individual to be considered alone (10). Moreover, even within the criteria of being physically separated from others, further conceptual distinctions can still be made. In some cases, solitude is defined as necessitating a lack of accompanying activity, sometimes referred to as *pure* solitude (11) or being alone with one's thoughts (12). In others, the central focus has been on characterizing and distinguishing among different activities that adolescents and young adults engage in alone [e.g., homework vs. watching videos, daydreaming vs. ruminating; (13)].

Other conceptualizations of solitude do not stipulate physical separation from others. From these perspectives, solitude occurs when we *feel* alone (14) and relates to our *perceived* social separation (15). Importantly, this allows for solitude to be experienced in the presence of others (i.e., alone in a crowd), such as sitting alone on a commuter train (16) or visiting an art gallery without a companion (17). To make matters more complicated, physical separation no longer implies a lack of social interaction. Advances in contemporary technology have made it commonplace to engage in computer-mediated interactions (including FaceTime) while physically alone (18). Indeed, Hipson et al. (13) recently reported that screentime (e.g., social media, texting, watching videos, playing video games) was the most common solitary activity among adolescents. In this regard, it has been recently suggested that solitude be reconceptualized as *non-communication* [i.e., not physically or virtually interacting with others; (19)]. Notably, adolescents have a nuanced conceptualization of the intersection between solitude and technology, defining different 'degrees' of solitude as a function of engagement in passive versus text-based versus audio-visual technologies (20).

Finally, there has been extensive research into the putative 'causes' of solitude in childhood and adolescence. For example, Rubin and Mills (21) distinguished between the processes of *active isolation* (children are forced into unwanted solitude due to peer rejection/exclusion) and *social withdrawal* (children remove themselves from opportunities for peer interaction). Asendorpf (22) later described different subtypes of social withdrawal, characterized by specific combinations of social approach and avoidance motivations. For example, *shyness* (high approach; high avoidance) is characterized by an internal conflict between the desire to engage with others and socio-evaluative fears. Of note, shyness shares conceptual overlap (but is distinct from) anxiety (particularly social anxiety), which can also fuel solitary behavior (23). Next, *social avoidance* (low approach; high avoidance) is characterized by both a high desire to avoid others and a drive to be alone. Lastly, *unsociability* (low approach; low avoidance) is characterized by a heightened preference for solitude in the absence of strong avoidance motivations (or feelings of anxiety). This motivational model served as the theoretical 'backbone' of social withdrawal research for the last 30 years. However, as noted by Coplan and Bowker (10), research on social withdrawal focuses almost exclusively on the causes and consequences of motivations for solitude, with only a handful of studies actually measuring time alone. With this in mind, we set out to provide a review and synthesis of how solitude has been operationalized and measured in studies of children, adolescents, and emerging adults.

Inclusionary and exclusionary criteria

Information regarding databases and search terms used, as well as inclusionary and exclusionary criteria is presented in Figure 1. We set a temporal criterion of articles published since the year 2000. Although this excluded seminal historical research in this area [e.g., (24, 25)], we felt it was important to focus on more contemporary perspectives. Next, although we initially intended to only include studies with samples of children and adolescents, we ultimately extended this criterion to include samples of emerging adults [i.e., ages 19–29 years; (26)].

The central aim of this review was to identify original published studies (in English) measuring *solitude*. This included studies with experimental manipulations [e.g., asking participants to sit alone in an empty room, e.g., Wilson et al. (12)], as well as studies assessing solitude over a predetermined period of time [e.g., participant completion of end of day reports, e.g., (27)]. In this regard, we did not include studies including only measures of solitude motivations, such as the *Child Social Preference Scale* [e.g., "If given the choice, my child prefers to play with other children rather than alone"; (28)] or general tendencies to engage in solitary behaviors, such as the *Child Behavior Scale* [e.g., "Withdraws from peer activities"; (29)]. In this same vein, we excluded studies focusing exclusively on attitudes and beliefs about solitude using quantitative [e.g., (30)] or qualitive assessments [e.g., (31)].

Finally, there have been several previous studies in which researchers employed naturalistic observations to assess children's non-social behaviors (e.g., reticence) and solitary play forms (solitary-passive, solitary-active) at schools/childcare centers, on playgrounds, and in laboratory playrooms (see (32), for a review). In these studies, a child is typically coded as being engaged in a 'solitary' activity when they are at least feet away from other children. Such behaviors, in the presence of peers, are well-established indicators of *social withdrawal* [i.e., removing oneself from opportunities for peer interaction; (3)]. However, children in this context are neither *physically* alone, nor can it be assumed that they *perceive* themselves as alone. Accordingly, for conceptual reasons, we decided to exclude such studies from our analyses.

Analysis of studies measuring solitude

After applying exclusionary criteria, our review of the extant literature identified N = 19 empirical studies. To organize our discussion of these studies, we grouped them into three broad methodological categories: (1) experiments/manipulations ($n = 5$); (2) retrospective reports ($n = 7$); and (3) experience sampling measures (ESM; $n = 7$). Key characteristics of these studies are displayed in Table 1.

Experiments/manipulations

Researchers conducting experiments on solitude aim to make causal claims regarding the implications of spending time alone. A key benefit of experiments involves the ability to randomly assign

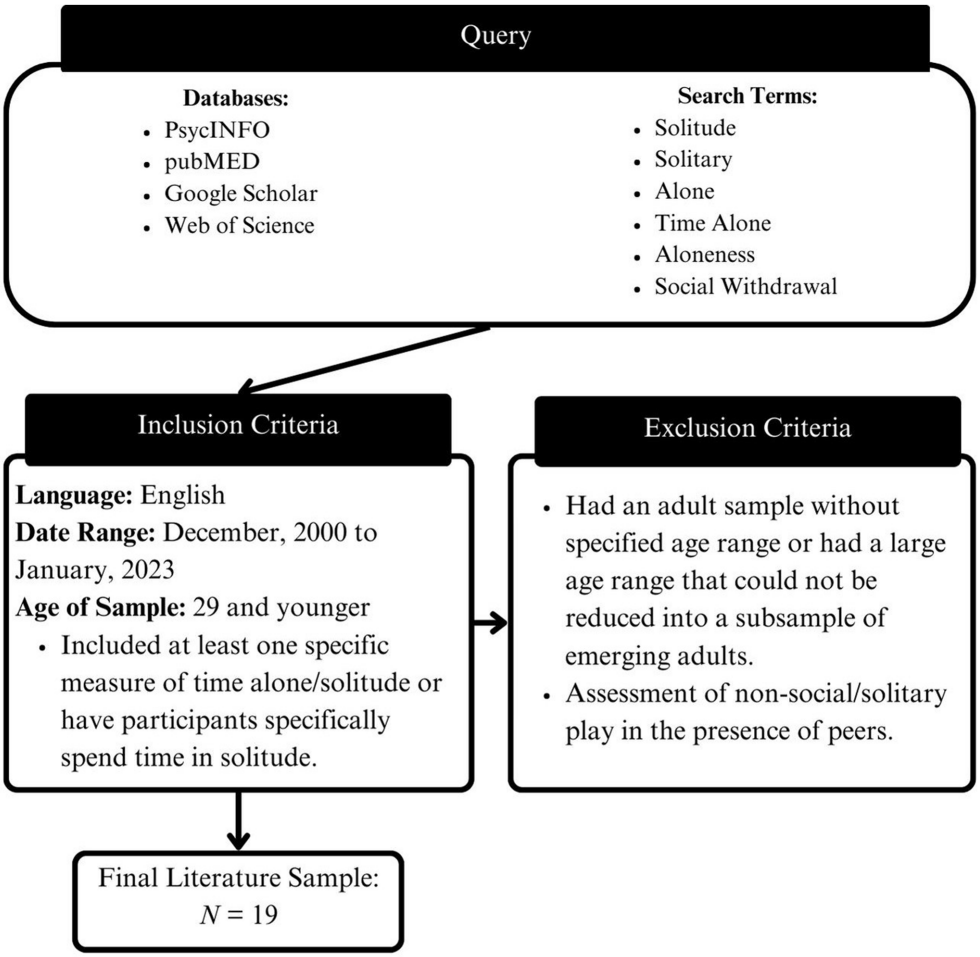


FIGURE 1
Flow diagram of the review process.

participants to different conditions (e.g., alone, with others), which increases internal study validity and provides more unbiased estimates (47). Researchers may also isolate the potentially salient aspects of solitude by controlling extraneous variables across conditions (e.g., solitary activities, timeframe, location, and autonomy). Of note, our review found that experimental studies of solitude have been conducted exclusively with emerging adults.

For instance, in a series of 11 experiments, Wilson et al. (12) investigated university students' experiences of solitude. The first six experiments involved asking participants to sit alone in a plain room without their belongings for anywhere from 6 to 15 min, with the only instructions being to "remain in their seats and stay awake" (p. 2). Across studies, participants reported overall low levels of enjoyment, high levels of boredom, and difficulty concentrating. In one follow-up study, findings extended beyond the lab to the home setting.

In other follow-up studies, Wilson et al. (12) compared the effects of being in pure solitude (i.e., physical solitude with no distractions) to those of engaging in mundane solitary activities, such as reading or listening to music. Results indicated that participants consistently preferred engaging in solitary activities over doing nothing. Indeed, the desire to avoid doing nothing was so strong, that in one experiment, many participants (especially men) chose to self-administer a previously experienced painful electric shock instead of sitting alone with their thoughts for 15 min. Taken together, findings suggest that engaging in pure solitude is an undesirable, and even aversive, way to spend time alone.

In a subsequent study, these findings were replicated across cultures. Buttrick et al. (33) compared experiences of *thinking* versus *doing* while alone in samples of college students from 11 countries (i.e., Belgium, Brazil, Costa Rica, Japan, Malaysia, Portugal, Serbia, South Korea, Turkey, United Arab Emirates, and United States). In the thinking condition, participants were instructed to "entertain themselves with their thoughts as best as they could, with the goal of having a pleasant experience" (p. e75) and no distractions or technological devices. In the doing condition, participants engaged in external leisure activities of their choice, such as reading, watching TV, surfing the Internet, playing video-games, or listening to music. School work and routine activities were not permitted, as the activity was intended to be enjoyable. Overall and across all countries, students reported enjoying spending time alone engaged in an activity more than spending time in pure solitude. However, it should be noted that participants did not particularly enjoy either condition. Overall ratings of enjoyment averaged 4.54 and 6.35 in the thinking versus doing conditions, respectively, on a scale with a possible range from 3 to 27.

TABLE 1 Studies examining solitude from childhood to emerging adulthood.

Article		Definition	Measurement	Participants
Experiments/manipulations				
	Wilson et al. (12)	N/A	Participants sat alone in a room for 6–15 min. Across 10 studies, variations of this protocol included different settings (i.e., lab room vs. at home) and different activities (doing nothing vs. engaging in self-selected solitary activities vs. being given the option to self-administer an electric shock)	N = 15–146 US college students
	Buttrick et al. (33)	N/A	Participants sat alone in a room a home for 12 min, instructed to either think or engage in external activities (e.g., reading, listening to music)	N = 2,557 college students (Belgium, Brazil, Costa Rica, Japan, Malaysia, Portugal, Serbia, South Korea, Turkey, United Arab Emirates, and United States)
	Nguyen et al. (11)	N/A	Participants sat alone in a room for 15 min. Across 4 studies, variations of the protocol included different activities (e.g., doing nothing vs. reading) and choice (e.g., choice vs. no choice), as well as variations in thought content (e.g., positive vs. neutral)	N = 108–343 undergraduate students ages 18–29 years
	Hatano et al. (34)	N/A	Participants sat alone for 3–20 min. Across five studies, variations of the protocol included different settings (e.g., lab room vs. booth), time (e.g., 3 vs. 20 min), and activities (e.g., doing nothing vs. browsing Internet)	N = 30–63 Japanese university students (M_{age} = 18.92–20.02)
	Nguyen et al. (35)	N/A	Participants sat alone in a room for 5–15 min. Across three studies, variations of the protocol included different activities (e.g., doing nothing vs. sorting pencils) and instructions (e.g., autonomy-supporting vs. autonomy-controlling)	N = 266–369 US university students ages 18–28 years
Retrospective reports				
	Leary et al. (36)	Not operationalized	Participants indicated how many times in the last month they engaged 12 solitary activities	N = 204 US university students
	Coplan et al. (37)	By yourself or doing something by yourself—not including sleeping	How many times were you alone in the last week for a period lasting at least 15 min? How many total hours did you spend alone in the last week?	N = 379 Canadian/US university students (M_{age} = 19.80)
	Archbell et al. (38)	Not operationalized	Parents reported on child's daily social activities between 6 am-8 pm (e.g., alone, with peers, with others)	N = 89 Canadian children ages 6–9 years
	Coplan et al. (39)	By yourself or doing something by yourself—not including sleeping	How many times were you alone in the last week for a period lasting at least 15 min? How many total hours did you spend alone in the last week?	N = 869 Canadian/US adolescents ages 15–19 years
	Hipson et al. (13)	By yourself or doing something by yourself—not including sleeping	How many times were you alone in the last week for a period lasting at least 15 min? How many total hours did you spend alone in the last week?	N = 869 Canadian/US adolescents ages 15–19 years
	Bosacki et al. (40)	Not operationalized	Participants reported how much time they spend alone during a typical day and week	N = 61 Canadian adolescents ages 11–18 years
	White et al. (27)	Activity not involving any direct physical or verbal interaction with others	Participants indicated whether they were mostly alone, with other people but not interacting, or with other people and interacting that day	N = 411 US university students ages 18–26 years
Experience sampling measures				
	Brown et al. (41)	Not operationalized	Participants indicated whether they were alone or with others 8 times a day for 7 days	N = 245 US university students
	Kwapil et al. (42)	Not operationalized	Participants indicated whether they were alone or with others 8 times a day for 7 days	N = 56 US university students (M_{age} = 21.2 years)
	Matias et al. (43)	N/A	Participants responded to the open-ended question "Who are you with?" Responses coded as "alone" or "not alone" (e.g., in the presence of others)	N = 44 Portuguese university students (M_{age} = 21 years)

(Continued)

TABLE 1 (Continued)

Article		Definition	Measurement	Participants
	Wang et al. (44)	Not operationalized	Participants indicated whether they were physically alone three times a day	$N = 28$ US university students ($M_{age} = 21.437$)
	van Roekel et al. (45)	Not operationalized	Participants reported whether they were alone or with others 9 times a day for 6 days	$N = 103$ Dutch adolescents ages 13–16 years
	Thomas et al. (18)	N/A	Participants indicated if they were: (a) physically alone and not communicating with anyone; (b) physically alone and communicating with someone; (c) around people but not interacting with them; (d) around people and interacting with them; (e) around people and communicating with someone not physically present	$N = 69$ US university students ages 18–35 years
	Uziel and Schmidt-Barad (46)	Being physically alone while not actively communicating with others	Participants indicated whether they were alone or with others	$N = 155$ Israeli university students ($M_{age} = 23.92$)

Definition = operational definition of solitude provided to participants; Measurement = measurement of solitude; not all studies provided demographic/geographic information.

Hatano et al. (34) subsequently examined the effects of just thinking among Japanese university students. Participants in this study were assigned to sit in pure solitude in various locations (e.g., room, dark booth) without their belongings for periods ranging from three to 20 min. Before the study began, participants rated how enjoyable they *expected* the assigned activity to be. Across experiments, participants found sitting alone with their thoughts more enjoyable, engaging, and interesting, as well as less boring than they had expected. In a follow-up experiment, participants were assigned to either spend 20 min in pure solitude or browsing Internet news sites alone. Although participants predicted they would enjoy the browsing activity more than the waiting activity, results showed that experiences did not differ between the conditions. So, there is at least some evidence to suggest that emerging adults enjoy being alone with their thoughts more than they think! As well, doing at least some specific activities while alone (i.e., browsing Internet news sites) is not necessarily better than doing nothing.

Having said that, *pure* solitude represents the most restrictive operational definition of solitude, eliminating other factors that may impact upon experiences while alone (e.g., location, choice of activity). However, as a result, this approach externally imposes the conditions of solitude (i.e., where, how long, doing what) and notably confounds context (solitude) with tolerance of inactivity. Given these constraints, it is perhaps not surprising that young people experience pure solitude so negatively. Another factor to consider is how participants' experiences of solitude are quantified. For example, in the aforementioned studies (33, 12), enjoyment of solitude was assessed by averaging participants' reports of how enjoyable, entertaining, and boring (reverse scored) the activity was. However, in terms of individuals' affective experiences during solitude, emerging evidence suggests that it is important to consider different combinations of *valence* (i.e., positive vs. negative) and *arousal* (i.e., activation vs. deactivation) (11, 35).

For example, in a series of studies, Nguyen et al. (11) instructed emerging adults to sit alone for 15 min without engaging in other activities. The researchers then compared the effects of this pure form of solitude to those of engaging in external solitary activities (e.g., reading). Across experiments, results supported a *deactivation* effect of solitude, such that spending time in solitude (regardless of whether participants engaged in an external activity) led to decreased high arousal positive affect (e.g., happiness) and increased low arousal negative affect (e.g., loneliness), along with increased low arousal positive affect (e.g., relaxation) and decreased high arousal negative affect (e.g., anger).

In a third experiment, the researchers randomly assigned participants to conditions differing based on both choice and thought content. In the choice condition, participants were instructed to "think during their time alone, but that they could choose to think either positive or neutral thoughts" (p. 96). In the no choice condition, participants were assigned to think either positive or neutral thoughts. Lastly, the control condition mirrored the earlier pure solitude condition. Although results again indicated that solitude had a deactivating effect, thinking positive thoughts (in either of the choice groups) inhibited the reduction in high arousal positive affect. These findings suggest that despite not being enjoyable, pure solitude confers some benefits (particularly in terms of increased restoration) and that (at least some of) the risks associated with solitude can be mitigated through regulating one's thoughts.

In a final experiment, Nguyen et al. (11) collected daily diary data over 2 weeks with using a *switching-replication* design to examine the implications of daily solitude on emerging adults' affect and well-being. The researchers randomly assigned participants to either "spend 15 min in solitude (i.e., without electronic devices or activities) sometime during each day of the first week of the study" (p. 100), or not engage in solitude during that week. During the second week of the study, the two groups switched tasks. At the end of each day, participants completed measures of affect, vitality, satisfaction, and stress. Consistent with the notion that emerging adults do not think they will enjoy spending time alone, almost a quarter of participants reported being non-compliant during supposed episodes of solitude (e.g., mentioning sleeping, eating, doing schoolwork, interacting with others remotely or in person, or engaging with technology). Notwithstanding, results again indicated a deactivating effect of

solitude for high-arousal positive affect and high-arousal negative affect. Solitude also predicted lower vitality, which is an energizing state. Interestingly, there was a *spillover effect* of solitude on arousal, such that participants who engaged in solitude during the first week of the study remained more deactivated during the second week. Although solitude was not associated with low arousal affective outcomes overall, participants with low autonomy for solitude reported lower low-arousal positive affect and higher low-arousal negative affect, as well as increased stress and reduced satisfaction after engaging in solitude. Participants with high solitude autonomy, on the other hand, reported higher low-arousal positive affect and less stress after engaging in solitude. Findings suggest that spending time alone is not only less harmful, but also more beneficial, when young people feel motivated to choose solitude for positive reasons.

As aforementioned, experimental studies typically impose conditions on participants' experiences of solitude. However, when aspects of solitude are externally constrained, they are more likely to result in negative experiences [e.g., (11)]. In this regard, Nguyen et al. (35) recently investigated whether the affective implications of solitude could be improved by enhancing autonomous motivation for solitude among emerging adults. In two studies, participants were first instructed to sit in a room without their belongings for 15 min. During this phase, the researchers manipulated participants' autonomy for solitude through use of either autonomy-supportive or autonomy-controlling language. Autonomy-controlling instructions included language such as "you must" or "you should," and stressed that the experimenter "expected" the participant to sit alone without engaging in other activities (p. 3). Autonomy-supportive instructions included language such as "I invite you to" and "you can," and the researchers emphasized that "different people might have different reactions to the activity so that participants could feel free to explore their feelings with a sense of choice" (p. 3). Finally, participants were presented with a *free choice* period, wherein they chose between sitting alone with their thoughts and sorting pencils for 10 min.

Consistent with Nguyen et al.'s (11) findings, results indicated that high arousal positive and negative affect decreased after participants engaged in pure solitude in both studies. However, although low arousal positive affect also increased in both studies, low arousal negative affect was found to increase in the second study, but not the first. During the free choice period, participants were much more likely to sort pencils than sit with their thoughts. These findings further support the idea that although engaging in pure solitude may offer benefits in terms of emotion regulation (11), doing nothing is not appealing to emerging adults (33, 12). When given the choice, even mundane (e.g., pencil sorting) and aversive (e.g., self-administration of an electric shock) activities are preferred. Interestingly, although the manipulation of autonomy for solitude was successful, autonomous motivations for solitude did *not* play a significant role in participants' responses to solitude.

Taken together, studies relying on experimental methods highlight a key theme in solitude research: young people clearly prefer doing something over doing nothing while alone (although engaging in pure solitude may confer affective benefits related to increased peace and relaxation). As such, it is important to consider solitary activities when understanding solitary experiences. These findings also provide some insight into the importance of choice. Having high autonomy related to solitude may not only protect against the potential negative outcomes of time alone, but it may confer unique affective benefits. Still, evidence regarding the importance of choice is mixed, with one study showing that outcomes of solitude remained consistent regardless of differences in autonomous motivations for solitude (35).

Although experimental studies allow for a high degree of precision and control (which is important for isolating the effects of solitude), such studies may lack external validity (48). Indeed, given what is known regarding young people's perceptions of pure solitude, it is unlikely that adolescents and emerging adults spend considerable time alone with their thoughts in real life. In this regard, solitude may look (and function) quite different outside of the laboratory setting. Moreover, when aspects of solitude are externally constrained, they are more likely to result in negative experiences (11). As such, it is also important to examine *naturally occurring* solitude.

Retrospective reports

To explore solitude in naturalistic settings, some researchers have examined *retrospective* reports of time spent alone. Our review revealed studies asking participants to recall instances of solitude over specified periods of time ranging from the end of the day to the previous week. Whereas experimental studies of solitude focused exclusively on emerging adults, retrospective studies also include samples of adolescents and children. These studies differ from the previously described experimental designs insofar as they assess naturally occurring episodes of solitude. In this regard, the results can speak more generally to the association between time spent alone and adjustment.

For example, Coplan and colleagues (13, 37, 39) assessed retrospective reports of both episodes of solitudes (i.e., how many times were you alone in the last week for a period lasting at least 15 min?) and time spent alone (i.e., how many total hours did you spend alone in the last week?) in samples of adolescents and emerging adults. Time alone was operationalized for participants as "by yourself, or doing something by yourself, not including sleeping" (e.g., (37), p. 20). An aggregate score of solitude was computed by averaging these two items.

Using this measure, Coplan et al. (37) found that weekly solitude was positively related to emerging adults' preference for solitude and loneliness (but not stress), and negatively related to feelings of aloneliness (i.e., negative feelings that arise from the perception that you are not spending enough time alone). Interestingly, aloneliness was highest among emerging adults who reported a higher preference for solitude yet spent little time alone. In a second sample, time alone was also positively related to emerging adults' depressive symptoms and stress. However, among emerging adults who reported feeling more alonely, the link between time alone and depressive symptoms was attenuated. These findings suggest that when young people are dissatisfied with the amount of time they have been spending alone, seeking solitude need not be risky. Moreover, finding time away from others may be particularly important for those with high preference for solitude.

In a later study using this measure with adolescents, Coplan et al. (39) reported that, overall, self-reported time alone was negatively

related to sociability and positive affect, and positively related to shyness and negative affect. Still, results from follow up person-oriented analyses further emphasized that not all time alone is created equal. Four sub-groups of adolescents were identified that spent comparatively more time alone than their peers. For two of these groups, frequent solitude was associated with maladaptive motivations and negative emotional experiences. Specifically, the group labeled *shy-withdrawn* was characterized by high shyness and high sociability, as well as high negative affect, whereas the *socially avoidant* group reported high shyness and low sociability, as well as high negative affect and low positive affect. In contrast, two other groups reported higher time alone, but appeared more normative and positively adjusted. Specifically, the *unsociable* group reported low sociability, but also low negative affect, whereas the group labeled *balanced* was characterized by the unique combination of high sociability, low shyness, and high positive affect. Of note, intrinsically motivated solitary activities were reported as more common among *unsociable* and *balanced* adolescents, which the authors postulated may have accounted for lower reported aloneliness among these groups.

Finally, in another study of adolescents using the same measure, Hipson et al. (13) reported that time alone was positively related to preference for solitude and negative affect, as well as negatively related to positive affect. It should be noted, however, that the link between time alone and positive affect was *curvilinear*. That is, at less than 1 h per day, time alone was not correlated with positive affect. At moderate levels, then, perhaps time away from others is less harmful for young people [see also (6)].

Hipson et al. (13) provided further evidence that not all time alone is the same. Participants were asked to list the three things they did the most when they were alone over the last week. The most commonly endorsed solitary activities included passive screen time (e.g., Netflix; 41%), homework (40%), and listening to music (23%). Although daydreaming was reported by 18% of adolescents, other types of thinking activities (e.g., negative thinking, planning) were more uncommon (~5%). Moreover, few participants reported engaging in meditation (4%), relaxing (4%), or doing nothing (6%), which provides further support for the notion that pure solitude is not favorable (12, 33, 35).

Results from subsequent person-oriented analyses revealed three sub-groups of adolescents characterized by their engagement in different patterns of solitary activities. The largest group included over half the sample (53%) and was comprised of adolescents who typically engaged passively with technology (e.g., watching TV) or did homework while alone. Adolescents in the second-largest group (31.7%) tended to spend their solitary time engaged in more active forms of technology use (e.g., social media and video games), as well as hobbies, homework, and listening to music. Lastly, the smallest group (15%) included adolescents who spent time alone primarily engaged with their thoughts.

When comparing solitary activity groups on indices of well-being, findings revealed that adolescents who spent considerable time in pure solitude (e.g., thinking, ruminating) experienced increased depression, anxiety, and loneliness as compared to those who engaged in other solitary activities. Indices of adjustment did not differ between adolescents who spent time alone passively engaged with technology and those who participated in more active activities, suggesting that doing something (regardless of what that something is) is better than doing nothing. Notably, the groups did not differ in preference for solitude.

Bosacki et al. (40) employed a similar methodological approach with a sample of adolescents during the COVID-19 pandemic, but included questions regarding experiences over the course of a *typical* week (i.e., how many times are you alone during a typical week?) and day (i.e., how many times are you alone during a typical day?). Participants also indicated whether they were typically physically alone more than with others and whether it was their choice to be alone (i.e., yes, no). However, 'alone' was not operationally defined for participants. Results revealed that adolescents engaged in one or two episodes of solitude lasting at least 15 min each day and spent approximately 8 h alone each week. Older adolescents also reported spending more time alone than younger adolescents.

Almost 70% of adolescents indicated that they were with others more often than alone and 65% reported spending time alone by choice. These findings indicate that, more often than not, adolescents seek solitude volitionally. Bosacki et al. (40) also reported that weekly (but not daily) solitude was positively related to preference for solitude, suggesting that adolescents with higher preference for solitude may spend more time away from others. Engaging in solitude for external reasons (but not by choice) was associated with higher social anxiety and negative affect, as well as poorer self-perceptions. Thus, agency may be critical in determining outcomes of time alone.

White et al. (27) asked undergraduate students to report on daily time alone over a 7-day period. At the end of each day, participants indicated whether they were mostly alone, with other people but not interacting with them, or with others and interacting for five timeframes (i.e., waking up to 9:00 am; 9:00 am to 12:00 pm; 12:00 to 3:00 pm; 3:00 to 6:00 pm; 6:00 to 9:00 pm). Among the results, emerging adults who spent more time alone overall experienced increased high arousal positive affect *when with others*. Moreover, spending more time alone than usual was associated with increased low and high arousal positive affect when with others on the same day at the within-person level. Interestingly, on days when participants spent increased time alone, shyness and avoidance were both associated with higher anxious affect (and avoidance with higher low arousal negative affect) during social encounters, whereas unsociability was associated with lower anxious and low arousal negative affect during social encounters. Taken together, although time spent alone may be beneficial for most emerging adults, those high in shyness or avoidance may struggle to re-integrate into social settings after periods of extended solitude.

White et al.'s (27) findings provide some of the first empirical evidence to support a widely held theoretical perspective that time away from others provides space for renewal, particularly for those who enjoy solitude. Related to this notion, Leary et al. (36) examined solitary activities in a sample of undergraduate students. Participants indicated how many times in the last month they engaged in a list of 12 activities "by themselves" (p. 62–63). Frequency and enjoyment of solitary activities was predicted more by increased solitropism (i.e., desire for aloneness) than sociotropism (i.e., desire to avoid others). The authors speculated that by spending time alone, individuals with higher preference for solitude may free themselves from social expectations and manage their arousal and stress levels. In a way, then, solitary activities may act as a social battery charger, bringing more balance to young people's lives and better enabling them to thrive interpersonally.

Finally, our review of the literature revealed only a single study where researchers measured time alone in a sample of children. Archbell et al. (38) conducted a series of end of day telephone interviews with parents of early elementary school students (grades 1–3). Interviews were conducted on three different weekdays and two weekend days over 4 months. For each interview, parents reported the social context of their child's daily activities in 2-h intervals between 6 am and 8 pm (e.g., alone, with peers, with others). Results revealed that, on average, children spent only about 10% of their time outside of school alone. Parents also reported that children in Grade 3 spent significantly more time alone than children in Grade 1. Associations between time alone and well-being indices were not examined.

Results from retrospective studies further highlight the importance of considering differences in autonomy and activity when examining solitude. Engaging in solitude by one's own volition may protect against the negative effects of increased time alone in adolescence (40). Further, findings from these studies highlight that individuals may choose to be alone for various reasons. Adolescents and emerging adults who are motivated to approach solitude for positive reasons (e.g., enjoyment), may benefit from taking time alone to recharge, whereas those seeking solitude to avoid social situations perceived as anxiety-provoking or unpleasant may be particularly at risk for negative outcomes (27, 37, 39).

Finally, findings from retrospective studies suggest that, similar to their emerging adult counterparts, adolescents do not favor pure solitude. Rather, they prefer spending time alone engaged with technology, homework, or hobbies (13). When it comes to the implications of solitude, doing something (particularly when that something is intrinsically motivated) is better than doing nothing (13, 39). It should be noted that only one retrospective study considered potentially important differences in valence and arousal when examining the affective outcomes of solitude.

Experience sampling measures

One limitation to retrospective approaches is that individuals may struggle to accurately recall how much time they spent alone (or what they did) over a period of days to weeks (49). To combat recall issues and enhance ecological validity, researchers have begun using ESM to examine naturally occurring experiences of solitude *as they unfold in real time*. Such studies (which often rely on smartphones or other technological devices) have become especially popular with the rise of technology (50). ESM studies provide multiple observations per person and allow researchers to test hypotheses at within- and between-person levels. As such, this approach to conducting research allows for a rich understanding of young people's social experiences (51).

Our review revealed only one study using ESM methods to measure solitude among adolescents. Van Roekel et al. (45) assessed adolescents' (aged 13–16 years) feelings of loneliness across social contexts and locations. Participants responded to nine random beeps a day for 6 days. After each notification, adolescents indicated whether they were alone or with others. 'Alone' was not operationalized. Those indicating that they were in company also responded to an open-ended question regarding who they were with. The researchers then categorized responses to family (e.g., parents or siblings), friends, classmates, or others (e.g., team-mates or teachers).

Consistent with previous retrospective studies, adolescents were in company more often than they were alone (40, 46). Moreover, momentary solitude predicted higher levels of loneliness across genders and locations. When comparing the effect of solitude across two consecutive assessments, results revealed that being alone at the previous assessment had a prolonged negative effect on adolescents' loneliness when they were with family at the next assessment. However, when adolescents were with friends at the next assessment, they reported feeling less lonely. Van Roekel et al. (45) suggest that this *relief effect* may stem from adolescents' desire to be around friends. Results here may also provide some support for White et al.'s (27) recent assertion that increased solitude helps emerging adults recharge, thereby allowing them to experience more enjoyment when interacting with others the same day. However, motivations for solitude and solitary activities were not considered.

In terms of studies with emerging adults, Kwapil et al. (42) examined links between social anhedonia and experiences of solitude in a small sample of female university students using ESM. Participants received alerts using palm pilots eight times a day over 12 h (12:00 pm to 12:00 am) for 7 consecutive days. After each notification, participants had up to 5 min to begin the assessment, where they indicated whether they were alone or with others. 'Alone' was not operationally defined. Participants then responded to questions regarding their experience of the social context, as well as positive and negative affect. Results revealed that social anhedonia was associated with a greater likelihood of being alone at the time of assessment, but also with choosing to be alone and enjoying solitude. Interestingly, although solitude was linked to higher negative affect (but not positive affect) overall, participants higher in social anhedonia reported lower negative affect and higher positive affect while alone. Findings are consistent with the idea that social motivations can moderate the impact of solitude on affective well-being.

Brown et al. (41) also examined social anhedonia in a university sample using ESM. Participants were notified eight times via palm pilot (between noon and midnight) for 7 days. After each notification, participants had 5 min to begin completing the questionnaire, which assessed affect (i.e., positive and negative affect, anxiety, sadness, and self-consciousness), social contact (i.e., alone vs. with others), cognitions, and activities. 'Alone' was not operationalized. Among the results, being alone was associated with higher momentary negative and lower positive affect compared to being with others. Social anhedonia predicted increased time alone and increased desire to be (and stay) alone, as well as disengagement in social contexts. Social anxiety, on the other hand, predicted increased desire to be alone when with others (especially acquaintances). However, social anxiety was not related to time alone or lower desire to be with others when in solitude. In addition, social anxiety was related to feelings of social rejection, but social anhedonia was not. Consistent with Kwapil et al. (42), these findings suggest that young people high in social anhedonia prefer solitude. Findings regarding social anxiety tell a different story, wherein socially anxious individuals want to engage with others; however, their desire and level of comfort in doing so is related to relationship closeness.

Matias et al. (43) examined how momentary solitude relates to affective experiences and cortisol in a sample of female college students. Participants received random notifications through electronic pagers eight times a day (between 8:00 am and 11:00 pm) for six consecutive days. In each instance, participants responded to

the open-ended question, "Who are you with?" Responses were coded as either "alone" (e.g., alone, alone in a room) or "not alone" (e.g., alone in a crowd, with friends, with colleagues). Participants also provided momentary ratings of their positive (i.e., happy, joyful, cheerful, in a good mood) and negative (i.e., sad, bored, lonely) affect, as well as anxiety. Compared to being with others, being alone was linked to lower momentary positive affect and greater negative affect (but was unrelated to anxiety). The researchers also found that being in solitude directly predicted higher cortisol levels compared to being with others, especially among participants high in general negative affect or low in general positive affect.

Uziel and Schmidt-Barad (46) used ESM to specifically examine how *choice* impacts emerging adults' experiences of being alone versus with others. Participants were notified three times a day via text (i.e., morning, noon, and evening), 5 days a week over a two-week period. After each notification, participants indicated whether they were alone (i.e., physically alone and not actively communicating with others) or with others (i.e., in the same physical space and/or actively communicating with others). Consistent with adolescents' retrospective reports (40), emerging adults in this study spent more time with others than alone (63% vs. 37%) and indicated that most of the time (73%), they were alone by choice. Among other results, being in solitude (compared to being with others) and being in non-chosen settings (compared to being in chosen settings) were linked to lower positive affect, satisfaction with life, and meaning, as well as higher negative affect overall. Social context also moderated the effect of choice, such that emerging adults reported poorer well-being when in solitude, regardless of whether they chose to be there or not. In contrast, when participants were with others, having a choice was beneficial for well-being. On the surface, these findings suggest that solitude is detrimental regardless of autonomy in decision-making. However, the researchers did not account for social motivations. Individuals may choose to spend time away from others for a variety of reasons (e.g., strong avoidance tendencies, enjoyment of solitude, social fears). As has been revealed in experiments and retrospective reports, differences in feelings about solitude may play an important role in the experience of being alone.

As aforementioned, it is now possible (and commonplace) to be physically alone while virtually engaging with others. Retrospective studies of solitude suggest that many young people spend time alone interacting with technology (13). Such findings are further supported through ESM studies. For example, Wang et al. (44) used ESM to examine the role of solitude in emerging adults' needs and media use. Participants were notified three times a day (i.e., lunchtime, early evening, before bed) via cell phone or another device. After each notification, participants reported whether they were physically alone. 'Alone' was not operationalized for participants. They also reported on their social media (e.g., Facebook, Twitter, YouTube, email) and other media (e.g., television, radio, magazines) use over the past several hours. Among the results, solitude was associated with increased social and especially other media use.

Thomas et al. (18) examined how momentary solitude relates to mood regulation abilities and identity development in university students. The researchers differentiated between being in true solitude (i.e., physical solitude without digital communication or social media) and physical solitude while engaged with others virtually. After downloading an app on their smartphone, participants were randomly notified seven times a day (during a 16-h timeframe) for 7 days. In this study, the authors did not simply differentiate between "alone" and "with others." Rather, participants selected one of five options that best fit their social status when prompted: (1) physically alone and not communicating with anyone (truly alone), (2) physically alone but also communicating with someone (on device alone), (3) around people but not interacting with them (around others), (4) around people and interacting with them (social), or (5) around people and also communicating with someone who was not physically present (social while on device). Participants who reported communicating with others when prompted also identified whether the means of communication was face-to-face, phone, letter, video, text, instant message, or social media platform.

Among the results, participants reported being truly alone 19% of the time, alone in the presence of others 17% of the time, and on their devices alone 9% of the time. Although the most common form of communication was face-to-face (40%), participants also frequently communicated via text (13%). Moreover, participants were already on their phone about a quarter of the time (26%) they were notified to complete momentary assessments (and on social media sites or messaging others 13% of the time). These results suggest that young people spend considerable time engaging with others virtually. However, neither time spent truly alone nor time spent alone on a device were related to indices of well-being or motivations for solitude overall.

A follow-up cluster analysis showed that introverts with higher preference for solitude demonstrated positive psychosocial adjustment (i.e., high identity development, autonomy, and positive relationships, and low loneliness) and low negative motivation for solitude. Interestingly, they also spent the most time in true solitude. Introverts without high preference for solitude, on the other hand, experienced more negative motivations for solitude, spent more time on social media, and demonstrated poor psychosocial adjustment (i.e., low identity development and high loneliness). In addition, being alone on one's device was associated with improved momentary affect when compared to being in true solitude; however, only among participants that did not want to be alone. These results collectively provide further support for the importance of considering individuals' internal motivations in conjunction with solitary activities when examining experiences of solitude. Spending increased time alone need not hinder psychosocial adjustment and well-being, if one is happy to be there.

Findings from ESM studies are largely consistent with conclusions emerging from our review of experimental and retrospective studies and provide additional support for the importance of considering the roles of autonomy, motivations, and solitary activities in the correlates of solitude.

Discussion

Measuring solitude: what matters?

In this review, we reviewed empirical studies including measures of solitude among children, adolescents, and emerging adults since the year 2000. These studies included three main methodological approaches: (1) experiments/manipulations; (2) retrospective reports; and (3) ESM. Each approach affords unique advantages and

disadvantages, and thus, continued use of these methodologies is warranted.

Regardless of what methods are employed, however, more studies on solitude are needed. In over 20 years, we uncovered only 19 empirical studies either instructing participants to engage in solitude or measuring naturally occurring instances of solitude. Moreover, most of these studies were conducted with samples of emerging adults, only a handful included samples of adolescents, and, astonishingly, after excluding observations of non-social play in the presence of peers, we found only a single study assessing solitude in children.

There may be methodological reasons for the lack of studies in childhood. For example, in terms of experimental designs, placing children (particularly young children) in a room alone may evoke safety concerns (52) and raise other ethical issues. Related to retrospective measures, research on temporal memory suggests that young children may not accurately recall how much time they spend alone in a day (53). As well, conducting ESM research with children evokes unique challenges, most notably non-compliance rates of over 50% (54).

There also remains considerable variation *within* measurement approaches employed in existing studies, and it is unclear how such variations might impact research results. For example, across all study types, researchers provide varying (or often no) operational definitions of 'solitude' for participants. Participants may have different conceptualizations and definitions of what it means to be alone (31), which may impact upon study findings. In *experimental* studies of solitude, it may be important to consider how long participants are instructed to spend alone [e.g., times ranged from 6 to 20 min; (12, 34)], and what participants can do during that time [e.g., nothing, read, or an activity of choice; (12), 33]. In *retrospective* studies, researchers have asked participants to report not only how much time they spent alone over varying specific time periods [e.g., last day vs. last week; (27, 39)], but also in a 'typical' day/week (40). In ESM studies, researchers typically ask participants to indicate whether they are alone or with others at random times over the course of a day (43, 46). Factors including number of daily assessments, types of items (e.g., single-item scales vs. multi-item scales), day of the week (i.e., weekday vs. weekend), and lag time between signal and response may all play a role (55).

Differences in outcomes assessed may also be of consideration. Studies typically consider positive and negative affect without distinguishing between valence and arousal. Emerging evidence indicates that solitude has a deactivating effect, wherein high arousal emotions are reduced and low arousal emotions are enhanced (11, 35). As such, examining links between solitude and positive and negative affect without considering arousal may paint an inaccurate picture of the outcomes of seeking time away from others. In adolescence, solitude also provides a context to work through important developmental tasks, such as gaining autonomy and forming strong identities (13). Researchers could thus expand beyond affective outcomes to include factors related to autonomy and identity formation. Other important outcomes to include may be academic and socio-emotional skills.

Despite these issues, overall and across methodologies, time alone was associated with negative outcomes for young people. However, even after considering measurement issues, experiences and implications of solitude vary according to several other factors. We discuss these briefly in the final section of this review, with an additional eye towards future research.

Measuring solitude moving forward: what else matters?

Doing nothing versus doing something(s)

When it comes to spending time alone, it is clear that engaging in pure solitude is not a sought out or particularly enjoyable experience for young people (33). Instead, adolescents and emerging adults generally prefer to spend time alone engaged in external activities, such as leisure activities, homework, and both passive and active technology use (13). In general, doing something while alone is more adaptive than doing nothing (13). Even adolescents who primarily engage in passive technology use (e.g., Netflix) while alone appear to be functioning quite well (13). Using social media while alone has also been linked to higher momentary well-being among emerging adults who would prefer to be with others (18).

Despite not being enjoyable, there are some benefits to engaging in pure solitude, particularly regarding emotion regulation (35). Of note, the content of one's solitary thoughts might be an important factor to consider. Results from several studies suggest that pure solitude is experienced negatively regardless of whether one is engaged in positive (e.g., daydreaming, planning) or negative thinking [e.g., ruminating; (13, 33)]. However, Nguyen et al. (11) found that thinking positive (but not neutral) thoughts inhibited the deactivation of high arousal positive affect. Taken together, solitary activities are heterogeneous and distinctive (13, 14), and *what you do* when you are alone matters in terms of experiences and implications of solitude.

Autonomy and motivations

It has been posited that choosing to spend time alone is beneficial in terms of enhancing creativity, self-reflection, and identity development (6). Our review suggests that in choosing when and how to engage in solitude, youth may also exercise their autonomy (13). Although adolescents and emerging adults typically engage in solitude volitionally (46), the impact of choice on young people's solitary experiences was mixed. Some studies suggest that choosing to be alone (as opposed to being alone for external reasons) protects against the negative outcomes of solitude (18), whereas others indicate that solitude hinders positive development regardless of autonomy in decision-making (46). Still, individuals choose to spend time in solitude for different reasons.

Previous research has focused predominantly on the implications of different motivations for seeking solitude, including shyness, unsociability, and social avoidance (10). Our review also uncovered some evidence to suggest that differences in motivations for solitude moderate the experience and impact of being alone. For example, for young people with higher unsociability (i.e., non-fearful preference for solitude), seeking high quality time away from others may be restorative (27) and lead to positive outcomes (18). In contrast, seeking solitude as an escape from unpleasant or anxiety-provoking social contexts (e.g., shyness, social avoidance) may inhibit the benefits that come with choosing to be alone and make it more difficult to re-integrate socially later on (18, 27).

Gender differences

Some evidence suggests that adolescent boys spend more time alone than girls (13, 45), but results from a meta-analysis indicate no gender differences in loneliness across the lifespan (56). Notwithstanding, the *implications* of choosing to spend time alone

may be worse for boys because solitary activities violate stereotypical gender norms regarding male dominance and social assertion (57). There is support of this notion, with results from several studies indicating that socially withdrawn boys evoke more negative responses from peers [e.g., (58)]. However, other results are mixed or even indicate more negative effects for socially withdrawn girls [e.g., (59)]. Further research is required to elucidate gender differences in other aspects of solitude, including when time alone might be differentially beneficial (or problematic) for boys versus girls.

Development beyond emerging adulthood

This review synthesized solitude research from childhood throughout emerging adulthood. Apart from our 'call to arms' for more of this research in children and adolescents, we would also like to highlight the continuing need for research beyond the emerging adult years. For example, *established* adulthood (i.e., age 30–45 years) represents a developmental stage characterized by a greater focus on career building and expanding one's family (60). Of note, established adults report greater preference for solitude than emerging adults (61) but may spend less time alone (62). This is worth further exploration, as aloneliness is associated with increased stress, negative affect, and symptoms of depression (37).

Beyond established adulthood, there has been a strong focus on social isolation and loneliness (as well as aspects of solitude) among the elderly [e.g., (63, 64)]. Findings from these studies highlight some of the themes that we have discussed. For example, Tse et al. (62) found that unchosen solitary experiences were associated with lower quality momentary experiences among older adults, whereas chosen solitary activities were positively associated with indices of well-being or quality of life.

Other studies offer more novel insights. For example, Lay et al. (65) identified individual characteristics beyond social motivations contributing to variation in older adults' experiences of solitude (e.g., social self-efficacy, rumination). Luo et al. (66) also found initial evidence to suggest that alternating between episodes of solitude and socializing promotes higher life satisfaction among older adults. It remains to be seen how these ideas might be applied to research with children and adolescents.

Measuring solitude in context

Finally, it will be critically important to consider solitude within broader societal and cultural *contexts*. The COVID-19 global pandemic resulted in lockdowns and social distancing across the world. We are only beginning to understand the profound impact of these experiences on young people's mental health and well-being (8). Most studies focus on feelings of loneliness and social isolation (67, 68), but several have specifically explored experiences of solitude (69, 70). This preliminary work raises many interesting possibilities for future research. For example, did individuals who enjoy solitude fare better during times of imposed social isolation (71)?

In addition, thanks to advancements in contemporary technology, young people can now be (and often are) physically alone but virtually engaging with others (13). As aforementioned, having a sense of autonomy can enhance the benefits of solitude, whereas spending time alone for externally imposed reasons is more likely to lead to negative outcomes (11). This leads to the question, what are the implications of engaging in *involuntary* digital solitude? Real life experiences of exclusion have been found to lead to solitude. For example, Ren and colleagues (72), Ren et al. (73) have demonstrated that experiences of ostracism lead to increased preference for solitude and solitude-seeking behaviors. Similarly, Beeri and Lev-Wiesel (74) found that real-life experiences of social rejection were related to increased psychological distress and social avoidance in adolescents. It has yet to be determined if *digital* rejection also leads to more negative solitary experiences both on- and off-line.

In turns of broader contexts, our review uncovered studies measuring solitude across a range of cultures. Notwithstanding, future research should continue exploring similarities and differences in solitude globally. For example, whereas preferring to do something over nothing while alone may be culturally universal (33), there are differences across countries in the correlates of motivations for solitude (75). There is still much to learn about how cultural norms regarding group orientation, privacy, encouragement of independence, and other relevant factors influence experiences of solitude (76).

Over the last two decades, a growing number of empirical research studies have explored the psychology of solitude in children and youth. However, a lack of consensus regarding conceptualizations, operational definitions, and measures of solitude continues to pose significant challenges. Moreover, there is a pressing need for studies exploring the characteristics and implications of children's time spent alone outside of school. Such studies will help to clarify for whom, when, how, and under what circumstances, solitude might confer costs versus benefits for child and adolescent development and well-being.

Author contributions

AM, TC, and LP conducted the literature searching. AM analyzed the studies. AM and RC wrote the manuscript with help from TC and LP on future directions. AM, RC, TC, and LP edited the manuscript.

Funding

This research was funded by SSHRC Insight Grant #435-2017-0849.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

1. Freud S. Civilization and its discontents. In J. Strachey (Ed. and Trans), *The Standard Edition of the Complete Psychological Works of Sigmund Freud* (Vol. *21*, pp. 57–145). Hogarth Press (1930/1961). (Original work published 1930)

2. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*, vol. *1*. Washington, DC: American Psychiatric Association (1952).

3. Rubin KH, Coplan RJ, Bowker J. Social withdrawal in childhood. *Annu Rev Psychol*. (2009) 60:141. doi: 10.1146/annurev.psych.60.110707.163642

4. Katz J, Buchholz ES. "I did it myself": the necessity of solo play for preschoolers. *Early Child Dev Care*. (1999) 155:39–50. doi: 10.1080/0030443991550104

5. Boulding E. *Children and Solitude* Pendle Hill Quaker Books & Pamphlets (1963).

6. Larson RW. The emergence of solitude as a constructive domain of experience in early adolescence. *Child Dev*. (1997) 68:80–93. doi: 10.2307/1131927

7. Ellis WE, Dumas TM, Forbes LM. Physically isolated but socially connected: psychological adjustment and stress among adolescents during the initial COVID-19 crisis. *Can J Behav Sci*. (2020) 52:177–87. doi: 10.1037/cbs0000215

8. Theberath M, Bauer D, Chen W, Salinas M, Mohabbat AB, Yang J, et al. *Effects of COVID-19 Pandemic on Mental Health of Children and Adolescents: A Systematic Review of Survey Studies*, vol. *10*. SAGE Open Medicine. Advance on-line publication: (2022).

9. Goffman E. *The Presentation of Self in Everyday Life* Penguin Press (1971).

10. Coplan RJ, Bowker JC. Looking beyond social motivations: considering novel perspectives on social withdrawal in childhood and adolescence. *Merrill-Palmer Q*. (2021) 67:390–415. doi: 10.13110/merrpalmquar1982.67.4.0416

11. Nguyen TT, Ryan RM, Deci EL. Solitude as an approach to affective self-regulation. *Personal Soc Psychol Bull*. (2018) 44:92–106. doi: 10.1177/0146167217733073

12. Wilson TD, Reinhard DA, Westgate EC, Gilbert DT, Ellerbeck N, Hahn C, et al. Just think: the challenges of the disengaged mind. *Science*. (2014) 345:75–7. doi: 10.1126/science.1250830

13. Hipson WE, Coplan RJ, Dufour M, Watanabe LK, Wood KR, Bowker JC. Time alone well spent? A person-oriented analysis of adolescents' solitary activities. *Soc Dev*. (2021) 30:1114–30. doi: 10.1111/sode.12518

14. Long CR, Seburn M, Averill JR, More TA. Solitude experiences: varieties, settings, and individual differences. *Personal Soc Psychol Bull*. (2003) 29:578–83. doi: 10.1177/0146167203029005003

15. Larson RW. The solitary side of life: an examination of the time people spent alone from childhood to old age. *Dev Rev*. (1990) 10:155–83. doi: 10.1016/0273-2297(90)90008-R

16. Epley N, Schroeder J. Mistakenly seeking solitude. *J Exp Psychol Gen*. (2014) 143:1980–99. doi: 10.1037/a0037323

17. Ratner RK, Hamilton RW. Inhibited from bowling alone. *J Consum Res*. (2015) 42:ucv012–283. doi: 10.1093/jcr/ucv012

18. Thomas V, Balzer Carr B, Azmitia M, Whittaker S. Alone and online: understanding the relationships between social media, solitude, and psychological adjustment. *Psychol Popular Media*. (2021) 10:201–11. doi: 10.1037/ppm0000287

19. Campbell SW, Ross MQ. Re-conceptualizing solitude in the digital era: from "being alone" to "noncommunication". *Commun Theory*. (2021) 32:387–406. doi: 10.1093/ct/qtab021

20. Coplan RJ, McVarnock A, Hipson WE, Bowker JC. Alone with my phone? Examining beliefs about solitude and technology use in adolescence. *Int J Behav Dev*. (2022) 46:481–9. doi: 10.1177/01650254221113460

21. Rubin KH, Mills RS. The many faces of social isolation in childhood. *J Consult Clin Psychol*. (1988) 56:916–24. doi: 10.1037/0022-006X.56.6.916

22. Asendorpf JB. Beyond social withdrawal: shyness, unsociability, and peer avoidance. *Hum Dev*. (1990) 33:250–9. doi: 10.1159/000276522

23. Bekkhus M, McVarnock A, Coplan RJ, Ulset VV, Kraft B. Developmental changes in the structure of shyness and internalizing symptoms from early to middle childhood. *Child Dev*. (2022). doi: 10.1111/cdev.13906

24. Gottman JM. Toward a definition of social isolation in children. *Child Dev*. (1977) 48:513–7. doi: 10.2307/1128647

25. Suedfeld P. Social isolation: a case for interdisciplinary research. *Can Psychol*. (1974) 15:1–15. doi: 10.1037/h0081737

26. Nelson LJ. The theory of emerging adulthood 20 years later: a look at where it has taken us, what we know now, and where we need to go. *Emerg Adulthood*. (2021) 9:179–88. doi: 10.1177/2167696820950884

27. White HI, Bowker JC, Adams RE, Coplan RJ. Solitude and affect during emerging adulthood: when, and for whom, spending time alone is related to positive and negative affect during social interactions. *Int J Behav Dev*. (2022) 46:490–9. doi: 10.1177/01650254221133

28. Coplan RJ, Prakash K, O'Neil K, Armer M. Do you 'want' to play? Distinguishing between conflicted-shyness and social disinterest in early childhood. *Dev Psychol*. (2004) 40:244–58. doi: 10.1037/0012-1649.40.2.244

29. Ladd GW, Profilet SM. The child behavior scale: a teacher-report measure of young children's aggressive, withdrawn, and prosocial behaviors. *Dev Psychol*. (1996) 32:1008–24. doi: 10.1037/0012-1649.32.6.1008

30. Galanaki EP, Mylonas K, Vogiatzoglou PS. Evaluating voluntary aloneness in childhood: initial validation of the Children's solitude scale. *Eur J Dev Psychol*. (2015) 12:688–700. doi: 10.1080/17405629.2015.1071253

31. Borg ME, Willoughby T. What does it mean to be alone? An analysis of interpretations of solitude among adolescents and adults. *Curr Psychol*. Advance on-line publication. (2022):1–8. doi: 10.1007/s12144-022-02796-7

32. Coplan RJ, Ooi LL, Hipson WE. Solitary activities from early childhood to adolescence: causes, content, and consequences In: RJ Coplan, JC Bowker and LJ Nelson, editors. *The Handbook of Solitude: Psychological Perspectives on Social Isolation, Social Withdrawal, and the Experience of Being Alone*. *2nd* ed: Wiley-Blackwell (2021). 105–16.

33. Buttrick N, Choi H, Wilson TD, Oishi S, Boker SM, Gilbert DT, et al. Cross-cultural consistency and relativity in the enjoyment of thinking versus doing. *J Pers Soc Psychol*. (2019) 117:e71–83. doi: 10.1037/pspp0000198

34. Hatano A, Ogulmus C, Shigemasu H, Murayama K. Thinking about thinking: people underestimate how enjoyable and engaging just waiting is. *J Exp Psychol Gen*. (2022) 151:3213–29. doi: 10.1037/xge0001255

35. Nguyen T-VT, Weinstein N, Deci E. Alone with our thoughts: investigation of autonomy supportive framing as a driver of enjoyment during quiet time in solitude. *Collabra: Psychol*. (2022) 8:8. doi: 10.1525/collabra.31629

36. Leary MR, Herbst KC, McCrary F. Finding pleasure in solitary activities: desire for aloneness or disinterest in social contact? *Personal Individ Differ*. (2003) 35:59–68. doi: 10.1016/S0191-8869(02)00141-1

37. Coplan RJ, Hipson WE, Archbell KA, Ooi LL, Baldwin D, Bowker JC. Seeking more solitude: conceptualization, assessment, and implications of aloneliness. *Personal Individ Differ*. (2019) 148:17–26. doi: 10.1016/j.paid.2019.05.020

38. Archbell KA, Coplan RJ, Rose-Krasnor L. What did your child do today? Describing young children's daily activities outside of school. *J Early Child Res*. (2020) 18:189–199. doi: 10.1177/1476718X19898

39. Coplan RJ, Hipson WE, Bowker JC. Social withdrawal and aloneliness in adolescence: examining the implications of too much and not enough solitude. *J Youth Adolesc*. (2021) 50:1219–33. doi: 10.1007/s10964-020-01365-0

40. Bosacki S, Quenneville S, Powell S, Talwar V. Canadian adolescents' solitude experiences, self-perceptions, and well-being. *J Silence Stud Educ*. (2022) 2:28–42. doi: 10.31763/jsse.v2i1.30

41. Brown LH, Silvia PJ, Myin-Germeys I, Kwapil TR. When the need to belong goes wrong: the expression of social anhedonia and social anxiety in daily life. *Psychol Sci*. (2007) 18:778–82. doi: 10.1111/j.1467-9280.2007.01978.x

42. Kwapil TR, Silvia PJ, Myin-Germeys I, Anderson AJ, Coates SA, Brown LH. The social world of the socially anhedonic: exploring the daily ecology of asociality. *J Res Pers*. (2009) 43:103–6. doi: 10.1016/j.jrp.2008.10.008

43. Matias GP, Nicolson NA, Freire T. Solitude and cortisol: associations with state and trait affect in daily life. *Biol Psychol*. (2011) 86:314–9. doi: 10.1016/j.biopsycho.2010.12.011

44. Wang Z, Tchernev JM, Solloway T. A dynamic longitudinal examination of social media use, needs, and gratifications among college students. *Comput Hum Behav*. (2012) 28:1829–39. doi: 10.1016/j.chb.2012.05.001

45. van Roekel E, Scholte RHJ, Engels RCME, Goossens L, Verhagen M. Loneliness in the daily lives of adolescents: an experience sampling study examining the effects of social contexts. *J Early Adolesc*. (2014) 35:905–30. doi: 10.1177/0272431614547049

46. Uziel L, Schmidt-Barad T. Choice matters more with others: choosing to be with other people is more consequential to well-being than choosing to be alone. *J Happiness Stud*. (2022) 23:2469–89. doi: 10.1007/s10902-022-00506-5

47. Barnow BS. Setting up social experiments: the good, the bad, and the ugly. *J Labour Market Res*. (2010) 43:91–105. doi: 10.1007/s12651-010-0042-6

48. Scandura TA, Williams EA. Research methodology in management: current practices, trends, and implications for future research. *Acad Manag J*. (2000) 43:1248–64. doi: 10.2307/1556348

49. Beckett M, Vanzo JD, Sastry N, Panis C, Peterson C. The quality of retrospective data: an examination of long-term recall in a developing country. *J Hum Resour*. (2001) 36:593–625. doi: 10.2307/306963

50. van Berkel NV, Ferreira D, Kostakos V. The experience sampling method on mobile devices. *ACM Comput Surv*. (2017) 50:1–40. doi: 10.1145/3123988

51. Bernstein MJ, Zawadzki MJ, Juth V, Benfield JA, Smyth JM. Social interactions in daily life: within-person associations between momentary social experiences and psychological and physical health indicators. *J Soc Pers Relat*. (2018) 35:372–94. doi: 10.1177/0265407517691366

52. Leung AKC, Robson WLM, Cho H, Lim SHN. Latchkey children. *J R Soc Health*. (1996) 116:356–9. doi: 10.1177/146642409611600603

53. Pathman T, Larkina M, Burch M, Bauer PJ. Young children's memory for the times of personal past events. *J Cogn Dev*. (2013) 14:120–40. doi: 10.1080/15248372.2011.641185

54. Vilaysack B, Cordier R, Doma K, Chen Y-W. Capturing everyday experiences of typically developing children aged five to seven years: a feasibility study of experience sampling methodology. *Aust Occup Ther J*. (2016) 63:424–33. doi: 10.1111/1440-1630.12336

55. Mölsä ME, Lax M, Korhonen J, Gumpel TP, Soderberg P. The experience sampling method in monitoring social interactions among children and adolescents in school: a systematic literature review. *Front Psychol*. (2022) 13:844698. doi: 10.3389/fpsyg.2022.844698

56. Maes M, Qualter P, Vanhalst J, Van den Noortgate W, Goossens L. Gender differences in loneliness across the lifespan: a meta-analysis. *Eur J Personal*. (2019) 33:642–54. doi: 10.1002/per.2220

57. Doey L, Coplan RJ, Kingsbury M. Bashful boys and coy girls: a review of gender differences in childhood shyness. *Sex Roles*. (2014) 70:255–66. doi: 10.1007/s11199-013-0317-9

58. Spangler T, Gazelle H. Anxious solitude, unsociability, and peer exclusion in middle childhood: a multitrait-multimethod matrix. *Soc Dev*. (2009) 18:833–56. doi: 10.1111/sode.2009.18.issue-410.1111/j.1467-9507.2008.00517.x

59. Menzer MM, Oh W, McDonald KL, Rubin KH, Dashiell-Aje E. Behavioral correlates of peer exclusion and victimization of east Asian American and European American young adolescents. *Asian Am J Psychol*. (2010) 1:290–302. doi: 10.1037/a0022085

60. Mehta CM, Arnett JJ, Palmer CG, Nelson LJ. Established adulthood: a new conception of ages 30 to 45. *Am Psychol*. (2020) 75:431–44. doi: 10.1037/amp0000600

61. Yuan J, Gruhn D. Preference and motivations for solitude in established adulthood: antecedents, consequences, and adulthood phase differences. *J Adult Dev*. Advanced online publication. (2022) 30:64–77. doi: 10.1007/s10804-022-09415-6

62. Tse DCK, Lay JC, Nakamura J. Autonomy matters: experiential and individual differences in chosen and unchosen solitary activities from three experience sampling studies. *Soc Psychol Personal Sci*. (2022) 13:946–56. doi: 10.1177/19485506211048066

63. Chen Y, Liu X. How solitude relates to well-being in old age: a review of inter-individual differences. *Scand J Psychol*. (2023) 64:30–9. doi: 10.1111/sjop.12862

64. Crewdson JA. The effect of loneliness in the elderly population: a review. *Healthy Aging Clin Care Elderly*. (2016) 8:1–8. doi: 10.4137/HACCE.S35890

65. Lay JC, Pauly T, Graf P, Biesanz JC, Hoppmann CA. By myself and liking it? Predictors of distinct types of solitude experiences in daily life. *J Pers*. (2018) 87:633–47. doi: 10.1111/jopy.12421

66. Luo M, Pauly T, Röcke C, Hülür G. Alternating time spent on social interactions and solitude in healthy older adults. *Br J Psychol*. (2022) 113:987–1008. doi: 10.1111/bjop.12586

67. Padmanabhanunni A, Pretorius TB. The unbearable loneliness of COVID-19: COVID-19 correlates of loneliness in South Africa in young adults. *Psychiatry Res*. (2021) 296:113658. doi: 10.1016/j.psychres.2020.113658

68. Witt A, Ordóñez A, Martin A, Vitiello B, Fegert JM. Child and adolescent mental health service provision and research during the Covid-19 pandemic: challenges, opportunities, and a call for submissions. *Child Adolesc Psychiatry Ment Health*. (2020) 14:19–1. doi: 10.1186/s13034-020-00324-8

69. Pauly T, Chu L, Zambrano E, Gerstorf D, Hoppmann CA. COVID-19, time to oneself, and loneliness: creativity as a resource. *J Gerontol B Psychol Sci Soc Sci*. (2022) 77:e30–5. doi: 10.1093/geronb/gbab070

70. Ren D, Stavrova O. Does a pandemic context attenuate people's negative perception and meta-perception of solitude? *Int J Psychol Adv Online Publ*. (2023) 58:134–42. doi: 10.1002/ijop.12885

71. Choi J, Kim N, Kim J, Choi I. Longitudinal examinations of changes in well-being during the early period of the COVID-19 pandemic: testing the roles of extraversion and social distancing. *J Res Pers*. (2022) 101:104306. doi: 10.1016/j.jrp.2022.104306

72. Ren D, Wesselmann E, Williams KD. Evidence for another response to ostracism: solitude seeking. *Soc Psychol Personal Sci*. (2016) 7:204–12. doi: 10.1177/1948550615616169

73. Ren D, Wesselmann ED, van Beest I. Seeking solitude after being ostracized: a replication and beyond. *Personal Soc Psychol Bull*. (2021) 47:426–40. doi: 10.1177/0146167220928238

74. Beeri A, Lev-Wiesel R. Social rejection by peers: a risk factor for psychological distress. *Child Adolesc Mental Health*. (2012) 17:216–21. doi: 10.1111/j.1475-3588.2011.00637.x

75. Bowker JC, Sette S, Ooi LL, Bayram-Ozdemir S, Braathu N, Bølstad E, et al. Cross-cultural measurement of social withdrawal motivations across ten countries using multiple-group factor analysis alignment. Advance on-line publication. *Int J Behav Dev*. (2023) 47:190–8. doi: 10.1177/01650254221132774

76. Chen X. Culture and shyness in childhood and adolescence. *New Ideas Psychol*. (2019) 53:58–66. doi: 10.1016/j.newideapsych.2018.04.007

frontiers | Frontiers in Psychiatry

TYPE Original Research
PUBLISHED 02 June 2023
DOI 10.3389/fpsyt.2023.1149319

OPEN ACCESS

EDITED BY
Louis A. Schmidt,
McMaster University, Canada

REVIEWED BY
Athanasios Gregoriadis,
Aristotle University of Thessaloniki, Greece
Xi Chen,
East China Normal University, China
Tingkai Cui,
Tianjin Medical University, China

*CORRESPONDENCE
Yan Li
✉ liyan@shnu.edu.cn

RECEIVED 21 January 2023
ACCEPTED 02 May 2023
PUBLISHED 02 June 2023

CITATION
Zhu J, Yin X, Li X, Dong X, Zou S and Li Y (2023) Social avoidance and social adjustment in Chinese preschool migrant children: the moderating role of teacher–child relationships. *Front. Psychiatry* 14:1149319. doi: 10.3389/fpsyt.2023.1149319

Social avoidance and social adjustment in Chinese preschool migrant children: the moderating role of teacher–child relationships

Jingjing Zhu, Xiaoqi Yin, Xiaoyun Li, Xinyi Dong, Shiyao Zou and Yan Li*

Early Childhood Education College, Shanghai Normal University, Shanghai, China

Objectives: This study aimed to explore the moderating role of teacher–child relationships in the relations between social avoidance and social adjustment (i.e., prosocial behavior, peer exclusion, and anxious-fearful behavior) in Chinese migrant preschoolers.

Methods: Participants were 148 migrant children aged 4–6 years (82 boys, M_{age} = 62.32, SD = 6.67) attending kindergartens in Shanghai, People's Republic of China. Mothers reported children's social avoidance, and teachers rated teacher–child relationships and children's social adjustment.

Results: Results indicated that social avoidance was positively related to peer exclusion and negatively related to prosocial behavior. Teacher–child relationships moderated those associations. Specifically, teacher–child closeness buffered the relationship between social avoidance and peer exclusion, whereas teacher–child conflict exacerbated the relations between social avoidance and peer exclusion and anxious-fearful behavior.

Conclusion: The current finding informs us of the importance of improving teacher–child closeness and reducing teacher–child conflict to buffer the negative adjustment among socially avoidant young children who migrated from rural-to-urban China. The findings also highlight the importance of considering the meaning and implication of social avoidance for migrant preschoolers in Chinese culture.

KEYWORDS

social avoidance, teacher–child relationships, preschool migrant children, social adjustment, China

Introduction

Peer interactions play a crucial role in children's social status and their smooth school adjustment (1). Accordingly, socially avoidant children who frequently refuse to engage in social interactions and seek to stay alone are more likely to miss the opportunities to develop positively (2, 3) and exhibit widespread social adjustment difficulties (e.g., internalizing problems and peer problems) (4, 5). Nevertheless, some factors may exacerbate or buffer socially avoidant children from social difficulties (6). Indeed, teacher–child relationships may influence children's developmental outcomes in kindergarten settings, including peer interactions (7, 8). Furthermore, in China, the remarkable increase in economically driven

rural-to-urban migration has led to a concomitant influx of rural children into the cities, forming a group of migrant children (9), who are more likely to face enormous challenges and suffer from various adjustment problems (10, 11). Moreover, teacher–child relationship status was worse for migrant children, which might be associated with more negative outcomes (12, 13). In the present study, we explored the potential moderating role of teacher–child relationships in the social adjustment of socially avoidant children in early childhood who migrated from rural-to-urban areas in China.

Overview of social avoidance in childhood

The children who frequently tend to remove themselves from social interactions were described as socially withdrawn and more likely to miss out on opportunities to learn from the social context (3). Social withdrawal is a multi-dimensional construct that includes shyness, unsociability, and social avoidance, which reflects different underlying motivational substrates (2, 3, 14). Specifically, *shy* children want to socialize with peers but show withdrawal behavior because of fearfulness and social evaluation anxiety (2, 15). In Western culture, extensive literature proved that shyness was associated with a range of adjustment difficulties from early childhood to adolescents, such as negative peer experience (e.g., rejection and victimization) and internalizing problems (e.g., loneliness, depression, and anxiety) (5, 16). While children considered *unsociable* usually have no interest in social activities and prefer to play alone, they would not actively refuse to interact with others (2, 17). Unsociability has been viewed as relatively benign in Western culture, which encourages personal choice and autonomy (18, 19). Unlike shyness, unsociability was not associated with the indices of peer difficulties and internalizing problems (16, 20).

In the current study, we focus on *social avoidance*, characterized by actively escaping social interactions and preferring to stay alone (2, 14). It should be noted that researchers pointed out that socially avoidant children may face the greatest risk of social and emotional difficulties (2, 16). Many previous studies have confirmed this standpoint that compared to shyness and unsociability, social avoidance was associated with more adjustment difficulties at various development stages, such as peer difficulties and internalizing problems (5, 21, 22). For example, Coplan et al. (21) found that in a sample of Canadian children (aged 9–12), compared to shyness and unsociability, socially avoidant children reported the highest scores on social anxiety and depression (21). A study conducted among American school-aged children found that peer-identified avoidant children were more likely to be disliked and faced more peer exclusion and victimization (22). Furthermore, Coplan et al. found that social avoidance was a significantly greater unique predictor of peer problems than shyness, but unsociability was not a significant predictor of peer problems among preschoolers in Canada (16). Therefore, based on the existing literature, it is known that social avoidance generally has a unique predictive effect on social maladjustment in various development stages.

Social avoidance in China

Due to culturally diverse backgrounds, social avoidance varies in its influence mechanism (23). In Western individualistic societies, withdrawing from the peer group may be seen as an expression of personal habits and autonomy (9).

Withdrawing from the peer group can be caused by many reasons in Western societies. For example, a longitudinal study highlighted the central role of negative peer relationships in the development course of social withdrawal during late childhood and early adolescence (24). Additionally, reduced family cohesion and increased parental conflict can lead to children's social withdrawal behavior (25). However, this individualistic preference to detach from the group and avoid social interaction may be considered negative in China, where social norms emphasize group harmony and cohesion, and encourage children to make friends and initiate social interactions (9, 26). A host of studies have supported this view, which consistently found that shy and unsociable children displayed internalizing problems and peer difficulties in urban China (4, 27).

Compared to shyness and unsociability, empirical studies of social avoidance were relatively limited in China, and the limited existing evidence revealed that social avoidance was also associated with more negative outcomes and maladjustment (e.g., peer exclusion, loneliness, academic outcomes, and anxious-fearful behavior) in various development stages (4, 6, 27), which may be the greatest risk subtype of social withdrawal (2, 16). For example, Sang et al. reported that, compared to shyness and unsociability, social avoidance had unique relationships with internalizing and peer problems among Chinese young adolescents (28). In addition, Ding et al. found that, compared to the hypothetical shy and unsociable peers, Chinese children in kindergarten and grade 1 anticipated that the hypothetical avoidant peers might have the most negative outcomes (26).

With the implementation of a full-scale market economy reform, China's society has undergone dramatic changes over the past years. Due to the changes in external factors such as living environment and various factors at the individual level, migrant children are often faced with huge challenges (11, 29–31). Studies have shown that compared with urban non-migrant children, migrant children have poorer academic performance and are more likely to suffer from various psychological problems such as inferiority complex, depression, and loneliness (11, 28, 32). Additionally, due to unfamiliar surroundings, migrant children are more likely to suffer from social anxiety in peer interactions (33). Therefore, Chinese migrant children who avoid social interaction may face the risk of being rejected and hated by their peers, which in turn makes it difficult for them to establish close peer relationships (16, 34).

On this background, it may be argued that adjustment difficulties continue to be elevated among migrant children, compared with non-migrant children, which may be reflected in the experiences of socially avoidant children. However, most studies on social avoidance and its adjustment were conducted on non-migrant children in Chinese cities. To the best of our knowledge, only minimal research has been carried out on social withdrawal and social adjustment in the particular group of migrant children living in urban areas in China, and mainly focused on the subtype

of shyness and unsociability (9, 35). Indeed, migrant children were more likely to maintain the traditional social behaviors valued in past China and children who were behaviorally inhibited and self-restrained were encouraged (19). Nevertheless, new behavioral characteristics, including cooperation and self-expression were increasingly encouraged in the competitive urban environment (36). Thus, the adjustment pressure of socially avoiding migrant children may be stronger in the new social requirements in urban China. Thus, exploring the social adjustment of socially avoidant migrant children in China is necessary, which can expand the research on social avoidance in Chinese migrant children. Furthermore, compared to school-age migrant children, preschool migrant children (aged 0–5) accounted for almost one-third of the total migrant children in China (37) and have been persistently neglected in previous literature (38). However, preschool migrant children are at a critical stage of individual development, when they might be more sensitive to stressful environments.

Given the lack of existing empirical evidence on social avoidance and adjustment in early childhood among Chinese migrant children, one goal of the present study was to explore the implications of social avoidance in a sample of Chinese migrant preschoolers.

The moderating role of teacher–child relationships

Given that avoidant migrant preschoolers in China may experience extensive social maladjustment, it is essential to identify the underlying moderating factors that may exacerbate or buffer the adjustment outcomes. It may further help the design of prevention and intervention programs for avoidant migrant preschoolers in China. The present study examined teacher–child relationships as the potential moderating factor between social avoidance and adjustment.

Children in their early years usually face the transition from family to kindergarten (8). According to attachment theory, preschool teachers serve as temporary attachment objects; in addition to playing the role of educator, they also play the role of caregiver in interactions with young children, and the nature of interaction directly affects the establishment of a safe emotional connection between preschool teachers and young children, which was similar to the parent–child relationship (8, 39). Thus, harmonious teacher–child relationships may have positive effects on children's development.

Researchers often measure the levels of closeness and conflict in teacher–child relationships (40–42). Specifically, *teacher–child closeness* referred to warm and open communication between teachers and their children and was associated with more positive developmental outcomes for children, such as more effective social-emotional skills and better academic skills (8, 43, 44). For example, Hartz et al. (45) revealed that positive and close relationships between teachers and preschoolers were associated with peer interactions. On the contrary, *teacher–child conflict* was manifested in the negative and highly tense relationships between teachers and their children and was associated with more negative developmental outcomes, such as lower academic achievement, more externalizing behaviors, and loneliness (46–48). For example, Li et al. found that teacher–child conflict in kindergarten related to future academic skills in primary school (40). In addition, Saral and Acar found that teacher–child closeness was positive and teacher–child conflict was negatively associated with preschool children's social competence (42). Higher levels of teacher–child closeness would mitigate the negative effect of parent–parent conflict on children's social competence (42). Thus, it seems reasonable to consider the role of teacher–child relationships, in the link between social avoidance and social adjustment in migrant preschoolers.

According to the *Diathesis Stress Model*, children with "risk" diathesis, such as children with social avoidance, are more likely to have adjustment difficulties or psychological disorders when encountering unfavorable external environments (49).

Socially avoidant children tend to be more sensitive and reactive to social stimuli, and they may have difficulty making friends or participating in group activities (50). This heightened sensitivity to social situations may make socially avoidant children more susceptible to negative experiences. Research has found that socially avoidant children experienced more negative outcomes, such as increased anxiety and peer exclusion when exposed to more maternal psychological control (51). Moreover, studies have indicated teacher–child conflict's risk role in exacerbating social adjustment difficulties (41, 42). Indeed, a previous study has shown that when children are exposed to more teacher–child conflict, they exhibit elevated internalizing and externalizing problems (52). Similarly, Zhu et al. (53) suggested that children with high teacher–child conflict had higher levels of behavior problems relative to other children. Therefore, when socially avoidant children experience a high level of teacher–child conflict, it increases the risk of children's social maladjustment (53).

However, socially avoidant children may also benefit more from a positive childcare environment, such as low levels of household chaos having a buffering influence on socially avoidant children's risk for interpersonal skills (6). In fact, teacher–child closeness has been demonstrated as a protective factor for children's social maladjustment (46, 54, 55). For example, Coplan et al. reported that at higher levels of teacher–child closeness, the relation between shyness and peer preference was attenuated in a sample of young Chinese children (46). In addition, the findings of a prospective cohort study with 7,343 preschool children suggested that shy children's risk for social difficulties can be mitigated by early teacher–child closeness (54). Furthermore, the *Attachment Theory* points out that teachers are important attachment objects and the safe harbor of children (56, 57). In this sense, when socially avoidant migrant preschoolers had positive relationships with their teachers, they would benefit from the supportive environment provided by teachers, which in turn leads to better social adjustment (54, 58).

To summarize, the association between social avoidance and social adjustment may be moderated by teacher–child relationships. Most existing evidence showed that children's social adjustment varies with teacher–child relationships. However, few studies has examined the moderating role of teacher–child relationships in the relationship between social avoidance and social adjustment in Chinese culture, not to mention among Chinese migrant children. Thus, in the present study, we examined the moderating role of teacher–child relationships between

social avoidance and social adjustment in a sample of Chinese migrant preschoolers.

The present study

As mentioned above, social avoidance and teacher–child relationships were associated with social difficulties among Chinese young children, such as peer difficulties, internalizing and externalizing problems, and social anxiety (6, 8). However, to date, nearly no study has explored the underlying mechanism of teacher–child relationships in the relationships between social avoidance and social adjustment in Chinese preschoolers, not to mention among the migrant preschoolers who are likely to experience worsened adjustment difficulties (10–12). Therefore, drawing upon the extant literature, we focused on three main aspects of social adjustment: prosocial behavior, peer exclusion, and anxious-fearful behavior.

In summary, the principal purpose of this study was to extend previous research by investigating the moderating role of teacher–child relationships (i.e., teacher–child closeness and teacher–child conflict) in the relationship between social avoidance and social adjustment (i.e., prosocial behavior, peer exclusion, and anxious-fearful behavior) among Chinese preschool migrant children. We hypothesized that social avoidance would be positively associated with peer exclusion and anxious-fearful behavior, while social avoidance was negatively associated with prosocial behavior. Moreover, in terms of the moderating effect of teacher–child relationship, we assumed that negative associations between social avoidance and social adjustment would be weaker among migrant children with higher levels of teacher–child closeness and stronger among those with higher levels of teacher–child conflict (see Figure 1).

Method

Participants

Participants consisted of 148 migrant children (82 boys, 66 girls, M_{age} = 62.32 months, SD = 6.76) recruited from two public kindergartens in Shanghai, People's Republic of China. The two kindergartens are "mixed kindergartens," where the migrant preschoolers attend kindergartens together with their non-migrant urban peers. In China, children attend kindergarten for 3 years and are grouped by age (e.g., juniors are 3–4 years old, middles are 4–5 years old, and seniors are 5–6 years old). All children were of Han ethnicity in this study, which makes up over 97% of China's population.

Nearly 22% of the mothers and 24% of the fathers had completed high school; 40% of the mothers and 27% of the fathers had completed junior college; 35% of the mothers and 41% of the fathers had earned a bachelor's degree; and 3% of the mothers and 7% of the fathers had earned a postgraduate degree. Maternal and paternal scores were averaged to create a broader measure of parental education (with higher scores representing higher education).

Procedure

The present study was reviewed and approved by the ethics review board of BLIND FOR PEER REVIEW. Every child in each of the participating classes was invited to take part in the study. The school obtained written permission from the parents of all children. Our study had 98% written consent. Mothers rated their children's social avoidance and teachers completed measures of children's social adjustment and teacher–child relationships.

Measures

Maternal ratings

Mothers completed the Chinese version of the Child Social Preference Scale (CSPS) (16). One of the most interesting subscales was the one assessing social avoidance, which consists of four items (e.g., "If giving a choice, my child prefers to play alone than with other kids"; α = 0.76). In exploring the implications of social avoidance among Chinese migrant children, it is imperative to control for any associated variance with shyness and unsociability due to the conceptual overlaps and similar patterns of adjustment (28). As such, mothers also completed the *shyness* subscale, which comprises seven items (e.g., "Although he/she appears to desire to play with others, my child is sometimes anxious about interacting with other children"; α = 0.89), and *unsociability* subscale, which comprises four items (e.g., "My child is just as happy to play quietly by his/herself than to play with a group of children"; α = 0.67) rated on a 5-point Likert-type scale (from 1 = "not at all" to 5 = "a lot"). Higher scores for CSPS-3 subscales indicated higher levels of social avoidance, shyness, and unsociability, respectively. The CSPS has demonstrated good reliability and validity in Chinese children (59, 60).

Teacher ratings

Teachers completed the Chinese version of the Student–Teacher Relationship Scale (STRS) (61, 62). In this study, we focused on conflict (12 items, e.g., "This child and I always seem to be struggling with each other"; α = 0.84) and closeness (11 items, e.g., "I share an affectionate, warm relationships with this child"; α = 0.85) scales of the STRS to measure teacher–child relationships. Items were rated on a 5-point Likert-type scale (from 1 = "definitely does not apply" to 5 = "definitely applies"). The STRS showed reliability and validity in young Chinese children (62).

Teachers also completed the Chinese version of the Child Behavior Scale (CBS) (63, 64). One of the most interesting subscales was the one assessing prosocial behavior (seven items, e.g., "often help"; α =0.90), peer exclusion (seven items, e.g., "not welcomed by other children"; α = 0.86), and anxious-fearful behavior (four items, e.g., "Poor concentration, attention span"; α =0.73). Items were rated on a 3-point Likert-type scale (from 1 = "doesn't apply" to 3 = "certainly applies"). The CBS has demonstrated good reliability and validity in Chinese children (64).

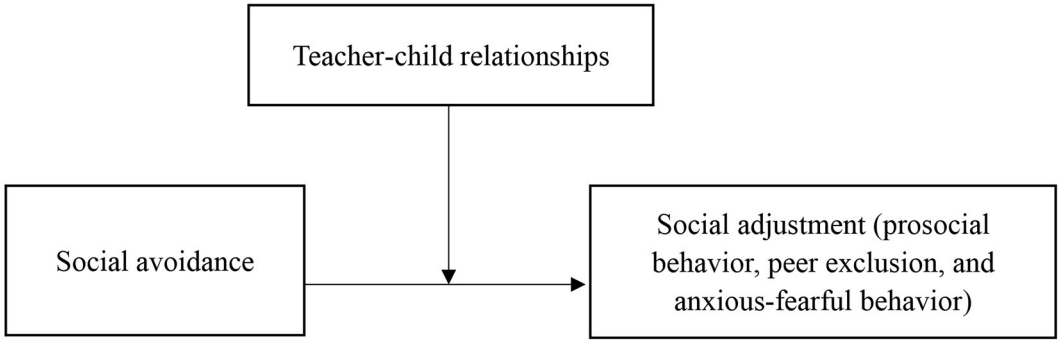


FIGURE 1
Hypothesis model.

Analytical strategy

We used SPSS 24.0 software for data analysis. Aiming to explore gender differences and correlations among study variables, we used a series of *t*-tests in preliminary analyses. Then we used the PROCESS macro (65) (Model 1) with non-parametric bootstrapping with 5,000 resamples to explore the moderating effect of teacher–child relationships between social avoidance and indices of social adjustment. For the test of significant interactions, we used a 95% bias-corrected confidence interval (CI) (66). The moderating effect was thought to be significant when the zero was not included in the 95% bias-corrected confidence interval (CI) of an interaction term (social avoidance × teacher–child relationships) (66). For the significant two-way interactions, we further conducted simple slope analyses and plotted the relationships between social avoidance and social adjustment variables in a high value (+1 SD above the mean) and a low value (-1 SD below the mean) of teacher–child relationships (67). In addition, in order to probe for significant regions of social avoidance on adjustment variables at different values of teacher–child relationships, each mother's ratings and teacher's ratings of each scale were transferred to z-scores, and then the Johnson–Neyman (J–N) technique (68) was conducted.

Results

Preliminary analyses

Results from *t*-tests indicated that there were significant gender differences in teacher–child conflict ($M_{boy} = 1.56$, $SD = 0.65$; $M_{girl} = 1.36$, $SD = 0.42$, $t = 2.23$, $p = 0.03$), teacher–child closeness ($M_{boy} = 3.65$, $SD = 0.75$; $M_{girl} = 3.92$, $SD = 0.68$, $t = -2.31$, $p = 0.02$), prosocial behavior ($M_{boy} = 2.25$, $SD = 0.57$; $M_{girl} = 2.45$, $SD = 0.52$, $t = -2.30$, $p = 0.02$), and peer exclusion ($M_{boy} = 1.23$, $SD = 0.43$; $M_{girl} = 1.07$, $SD = 0.20$, $t = 2.72$, $p = 0.01$). Gender differences had no effect on other variables. Accordingly, we controlled for child gender in subsequent analyses.

As shown in Table 1, child age was positively correlated with teacher–child closeness. Social avoidance was significantly and positively associated with peer exclusion, and negatively associated with prosocial behavior. Teacher–child conflict was also significantly and positively associated with peer exclusion and anxious-fearful behavior and negatively associated with prosocial behavior. Teacher–child closeness was significantly and negatively associated with peer exclusion and anxious-fearful behavior, and positively associated with prosocial behavior.

Social avoidance, teacher–child relationships, and social adjustment

The goal of the following analyses was to examine the moderating role of teacher–child relationships (i.e., teacher–child closeness and teacher–child conflict) in the relations between social avoidance and social adjustment (i.e., prosocial behavior, peer exclusion, and anxious-fearful behavior) while controlling for gender, age (only when the moderating variable was teacher–child closeness), shyness, and unsociability. Classroom intraclass correlations (ICCs) for all variables were <0.04, indicating no cluster effects in the classroom. The results of the regressions are shown in Table 2.

Results indicated that there were significant interaction effects between social avoidance and teacher–child conflict in relation to peer exclusion and anxious-fearful behavior. Furthermore, interaction effects between social avoidance and teacher–child closeness in relation to peer exclusion were significant (marginal significance). However, there were no significant interaction effects between social avoidance and teacher–child relationships (both teacher–child closeness and teacher–child conflict) found in relation to prosocial behavior.

Furthermore, in order to explain these significant two-way interactions, the simple slope effects were conducted on social avoidance at high and low values (1 SD above and 1 SD below the mean) of teacher–child conflict and closeness (67). The results of simple slopes are shown visually in Figures 2, 3. As shown in Figure 2, social avoidance had a positive association with peer exclusion for children with high teacher–child conflict ($b = 0.34$, $SE = 0.10$, $t = 3.40$, $p < 0.01$); on the contrary, this association was not significant for children with low teacher–child conflict ($b = -0.02$, $SE = 0.10$, $t = -0.15$, $p > 0.05$). As shown in Figure 3, social avoidance had a positive association with anxious-fearful behavior for children with high teacher–child conflict ($b = 0.31$,

TABLE 1 Descriptive statistics and Spearman correlations among all study variables ($N = 148$).

Variables	1	2	3	4	5	6	7	8	9	10	11
1. Gender	-										
2. Age (month)	−0.06	-									
3. Parental education	0.02	0.04	-								
4. Shyness	0.01	−0.07	0.02	-							
5. Unsociability	−0.08	−0.10	0.07	0.63***	-						
6. Social avoidance	0.06	−0.10	0.07	0.57***	0.62***	-					
7. Teacher–child conflict	−0.18*	0.06	−0.03	0.04	0.14	0.05	-				
8. Teacher–child closeness	0.19*	0.36***	0.04	−0.31***	−0.33***	−0.21*	−0.38***	-			
9. Prosocial behavior	0.19*	0.46***	0.10	−0.27***	−0.29***	−0.20*	−0.42***	0.72***	-		
10. Peer exclusion	−0.22**	0.01	0.04	0.20*	0.25**	0.23**	0.062***	−0.49***	−0.51***	-	
11. Anxious-fearful behavior	−0.05	−0.02	0.11	0.08	0.07	0.11	0.23**	−0.20*	−0.27***	0.41***	-
M	-	62.32	-	1.84	1.72	1.33	1.47	3.77	2.34	1.16	1.23
SD	-	6.76	-	0.68	0.57	0.48	0.56	0.73	0.56	0.36	0.36

*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

$SE = 0.13$, $t = 2.32$, $p < 0.05$); on the contrary, this association was not significant for children with low teacher–child conflict ($b = -0.06$, $SE = 0.13$, $t = -0.47$, $p > 0.05$). However, for the significant (marginal significance) interaction effects between social avoidance and teacher–child closeness in relation to peer exclusion, no results were found in the simple slope analysis.

Johnson–Neyman (J–N) technique was also conducted to probe the significant regions for significant interactions, as suggested by Hayes and Matthes (69).

The results are shown visually in Figures 4–6. As shown in Figure 4, when the score of teacher–child conflict was higher than 0.08 SD, social avoidance was significantly and positively associated with peer exclusion. However, when the score of teacher–child conflict was lower than 0.08 SD, social avoidance was no longer associated with peer exclusion. As shown in Figure 5, when the score of teacher–child conflict was higher than 0.63 SD, social avoidance was significantly and positively associated with anxious-fearful behavior. However, when the score of teacher–child conflict was lower than 0.63 SD, social avoidance was no longer associated with anxious-fearful behavior. As shown in Figure 6, when the score of teacher–child closeness was lower than −0.34 SD, social avoidance was significantly and positively associated with peer exclusion (marginal significance). However, when the score of teacher–child closeness was higher than 0.34 SD, social avoidance was no longer associated with peer exclusion.

Discussion

The present study expanded on previous research by examining the relations between social avoidance and social adjustment (prosocial behavior, peer exclusion, and anxious-fearful behavior) and the moderating role of teacher–child relationships in Chinese migrant preschoolers. The findings showed that social avoidance was significantly associated with prosocial behavior and peer exclusion. Moreover, teacher–child conflict exacerbated the relationship between social avoidance and migrant preschoolers' adjustment problem, whereas teacher–child closeness buffers the social adjustment difficulties of socially avoidant migrant preschoolers in China. These aspects of the results are discussed in detail below.

Association between social avoidance and social adjustment

As expected, results suggested that social avoidance was significantly and negatively associated with prosocial behaviors and significantly and positively associated with peer exclusion. These results were consistent with previous studies that social avoidance was associated with social maladjustment in Chinese migrant preschoolers (6). However, Zhu et al. found that social avoidance was not significantly associated with peer exclusion among non-migrant preschoolers living in urban areas in China (60). Thus, as compared to socially avoidant non-migrant preschoolers, socially avoidant migrant preschoolers might have poorer social skills and face more peer difficulties.

Based on *Embedding and Disembodying Theory* (70), migrant children were at risk of being under-embedded in the urban environment. They had to constantly face and cope with new and unfamiliar territory (71). Thus, socially avoidant migrant preschoolers were more likely to feel anxious or insecure about their interpersonal relationships (30, 31), which increased their avoidance of peer interaction. In addition, according to *Developmental Contextualism* (72), children prefer to interact with peers with similar behavior and attitude characteristics (73). However, as migrant families tend to maintain traditional socialized behavior, the attitudes and behaviors of migrant children are more

10.3389/fpsyt.2023.1149319

TABLE 2 Effects of social avoidance, teacher–child relationships in relation to indices of social adjustment.

Predictor	*B*	*SE*	*t*-value	95% CI
Social adjustment variables				
Peer exclusion				
Social avoidance	0.15^{+}	0.08	1.78	[−0.02, 0.31]
Teacher–child conflict	0.57	0.06	8.86***	[0.44, 0.70]
Avoidance × teacher–child conflict	0.20	0.06	3.18**	[0.07, 0.32]
Prosocial behavior				
Social avoidance	−0.02	0.10	−0.18	[−0.21, 0.18]
Teacher–child conflict	−0.38	0.08	−4.92***	[−0.53, −0.23]
Avoidance × teacher–child conflict	−0.09	0.07	−1.18	[−0.23, 0.06]
Anxious-fearful behavior				
Social avoidance	0.11	0.11	0.98	[−0.11, 0.32]
Teacher–child conflict	0.21	0.08	2.53*	[0.04, 0.38]
Avoidance × teacher–child conflict	0.20	0.08	2.49*	[0.04, 0.36]
Peer exclusion				
Social avoidance	0.16	0.10	1.64	[−0.03, 0.35]
Teacher–child closeness	−0.47	0.09	−5.35***	[−0.64, −0.29]
Avoidance × teacher–child closeness	−0.09	0.05	−1.76^{+}	[−0.19, 0.01]
Prosocial behavior				
Social avoidance	−0.03	0.08	−0.34	[−0.18, 0.13]
Teacher–child closeness	0.59	0.07	8.42***	[0.45, 0.72]
Avoidance × teacher–child-closeness	0.00	0.04	0.04	[−0.08, 0.08]
Anxious-fearful behavior				
Social avoidance	0.12	0.11	1.08	[−0.10, 0.35]
Teacher–child closeness	−0.21	0.10	−2.08*	[−0.42, −0.01]
Avoidance × teacher–child closeness	−0.02	0.06	−0.32	[−0.14, 0.10]

Gender, age (only when the moderating variable was teacher–child closeness), shyness, and unsociability were controlled in the analysis.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.
$^{+}$p < 0.01.

like those of peers in the countryside (9, 74). Thus, it is relatively more challenging for migrant socially avoidant preschool children to receive peer acceptance.

Then, we also found that social avoidance was significantly and negatively correlated with prosocial behavior. It could be that socially avoidant migrant preschoolers tend to remain isolated from peers, and naturally, it is difficult for them to initiate prosocial interactions with others (i.e., helping and comforting).

Moderating role of teacher–child relationships

Consistent with our hypotheses, teacher–child relationships moderated the association between social avoidance and the indexes of social adjustment.

Specifically, after controlling for shyness and unsociability, teacher–child conflict aggravated socially avoidant migrant children's peer exclusion and anxious-fearful behavior, and teacher–child closeness buffers the relationships between social avoidance and peer exclusion in Chinese migrant preschoolers.

Regarding the moderating role of teacher–child conflict, the result revealed that social avoidance was positively associated with peer exclusion and anxious-fearful behavior among migrant preschoolers with high teacher–child conflict in China, but not for the children with low teacher–child conflict. These findings align with previous findings, suggesting that higher levels of teacher–child conflict may play a dangerous role in peer interactions among socially avoidant migrant children (75). Teacher–child conflict may prevent socially avoidant migrant children from forming secure attachments with teachers. Based on the *Emotional Security Theory* (76), insecure attachment keeps children from feeling safe in kindergarten and further prompts social anxiety and fear of

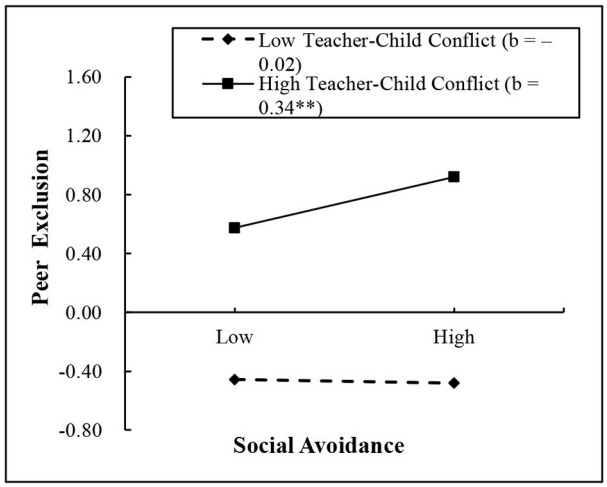


FIGURE 2
Interaction between teacher–child conflict and social avoidance on peer exclusion. $^{**}p < 0.01$.

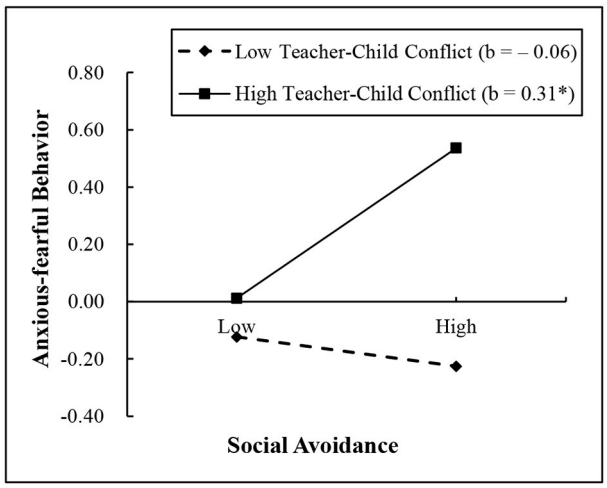


FIGURE 3
Interaction between teacher–child conflict and social avoidance on anxious-fearful behavior. $^{*}p < 0.05$.

interpersonal communication. Moreover, socially avoidant migrant preschoolers whom teachers do not support are less likely to pay attention to teachers' behaviors, which leads to fewer opportunities for them to learn social skills (77), thus showing peer problems. The findings supported the Diathesis Stress Model, in that the sensitivity of socially avoidant migrant preschoolers to negative environments would be intensified, and when they have experienced a high level of teacher–child conflict, they might feel more stressed and exhibit peer exclusion and anxious-fearful behavior.

We believe that the results of the present study need to be understood in the context of migrant children in China. Most migrant children often follow their parents from rural areas to urban areas. Their previous social experience is guided mainly by traditional values in rural areas but by a more modern value system in cities (78). Finding a balance between urban culture and rural culture is crucial for the social and school adjustment of migrant children (79, 80). For migrant children with social avoidance, they are more likely to suffer from social maladjustment after experiencing mixed social and cultural standards and belief systems. In addition, migrant preschoolers may adopt the adult-oriented approach to socializing in the family and school, and teachers' guidance and support role in school may further affect the functional significance of social avoidance in their adjustment to a certain extent. In contrast, teacher–child conflict aggravated the socially avoidant migrant preschoolers' maladjustment.

Regarding the moderating role of teacher–child closeness, no results were found in the further simple slopes analyses. However, the results of the regions for significant interactions found in the Johnson–Neyman technique further revealed that social avoidance was positively associated with peer exclusion when migrant children reported lower teacher–child closeness. However, social avoidance had a non-significant predictive effect on peer exclusion when migrant children reported higher teacher–child closeness. These findings were consistent with previous research identifying the protective role of positive teacher–child relationships in social-emotional function and academic performance from risk factors for the children (27, 55, 75). The challenges with migration (e.g., cultural differences, adjustment to a new living environment, and insecurity) can result in more profound feelings of loneliness, social anxiety, alienation, and worthlessness (11, 29, 33), and make it difficult for migrant children who already have difficulty in interacting socially to receive support in new relationships. In fact, social support is essential for children to cope with stress and adjustment difficulties (1). Therefore, social support from teachers is an important factor in helping socially avoidant children to cope with migrantions' stress and difficulties. Moreover, establishing close relationships with teachers will increase socially avoidant migrant preschoolers' sense of security at school (81) and embolden them to explore peer relationships boldly. Furthermore, *Social Learning Theory* pointed out that teachers can shape children's social interaction behaviors (54). The migrant preschoolers who always avoid interacting with peers may learn better social skills from close interactions with teachers. It is also possible that in a classroom environment with a high level of teacher–child closeness, teachers are more likely to provide more emotional care and encouragement to socially avoidant migrant preschoolers and help them develop effective strategies to interact with peers more positively (82). Additionally, children who are close to their teachers also seem to be more receptive to and actively participate in social activities arranged by their teachers, which in turn reduces their avoidance behavior, and the relationship between peers will be further improved, and peer exclusion will be reduced in the daily interaction with peers. In brief, the current study is the first to provide preliminary evidence to suggest that although social avoidance may have negative implications for Chinese migrant preschoolers, teacher–child closeness may serve as an important protective factor.

Contrary to expectations, teacher–child relationships (both teacher–child closeness and teacher–child conflict) not significantly moderated the effects of social avoidance on prosocial behavior. Previous studies revealed that preschoolers tend to be self-centered, and they may not pay much attention to peers, solitary behavior is

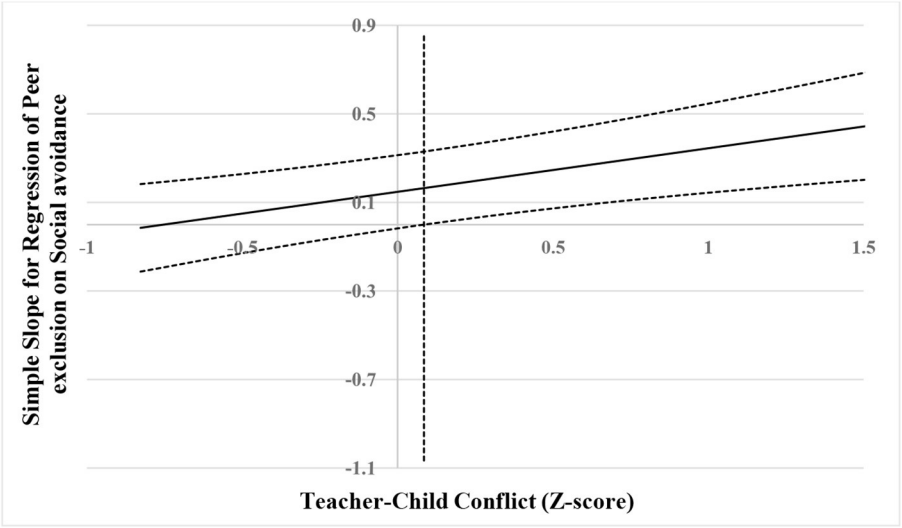


FIGURE 4
Johnson–Neyman regions of significance and confidence bands for mother-rated social avoidance along teacher-rated teacher–child conflict in relation to peer exclusion. Solid diagonal line represents the regression coefficient for social avoidance along teacher–child conflict. Dashed diagonal blue lines are confidence bands—upper and lower bounds of 95% confidence interval for social avoidance regression coefficient along teacher–child conflict. The vertical red dashed line indicates the point along teacher–child conflict at which the social avoidance regression coefficient transitions from non-significance (left of vertical dashed line) to statistical significance (right of vertical dashed line). The value of the vertical red dashed line is 0.08.

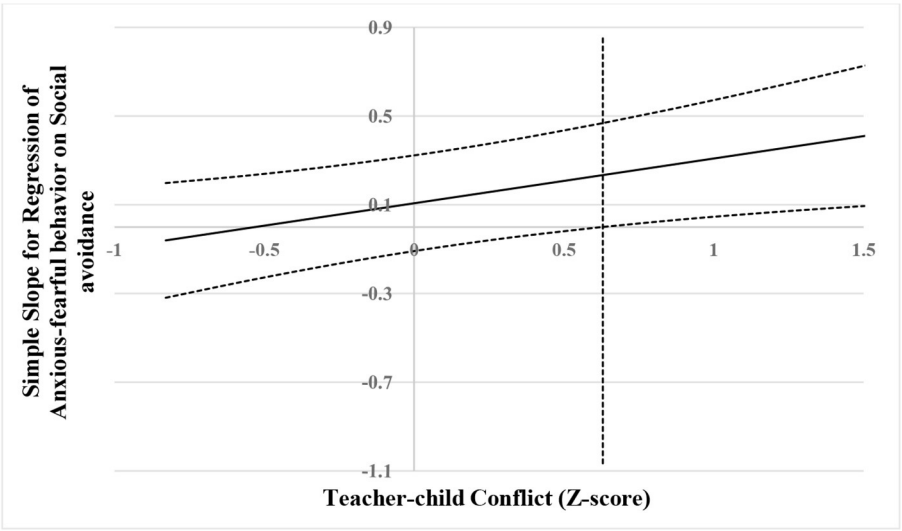


FIGURE 5
Johnson–Neyman regions of significance and confidence bands for mother-rated social avoidance along teacher-rated teacher–child conflict in relation to anxious-fearful behavior. The solid diagonal line represents the regression coefficient for social avoidance along teacher–child conflict. Dashed diagonal blue lines are confidence bands—upper and lower bounds of 95% confidence interval for social avoidance regression coefficient along teacher–child conflict. The vertical red dashed line indicates the point along teacher–child conflict at which the social avoidance regression coefficient transitions from non-significance (left of vertical dashed line) to statistical significance (right of vertical dashed line). The value of the vertical red dashed line is 0.63.

quite common (17). In addition, the behavior of socially avoidant preschoolers is characterized by a preference for solitude and avoidance of peer interaction, which teachers and parents may perceive as a manifestation of poor prosocial behavior. Moreover, migrant preschoolers in China generally have to face unfamiliar territory and challenging settings, and there may be many other factors related to prosocial behavior. For example, previous studies found that migrant families generally living at a lower level of socio-economic status, which led to more life stresses and conflict among family members (83), and further led to negative parent-child relationships which in turn affected migrant children's adjustment problems (83). Thus, the unique relationship between social avoidance and internalizing problems may not be exhibited in migrant preschoolers. Although these findings were unexpected,

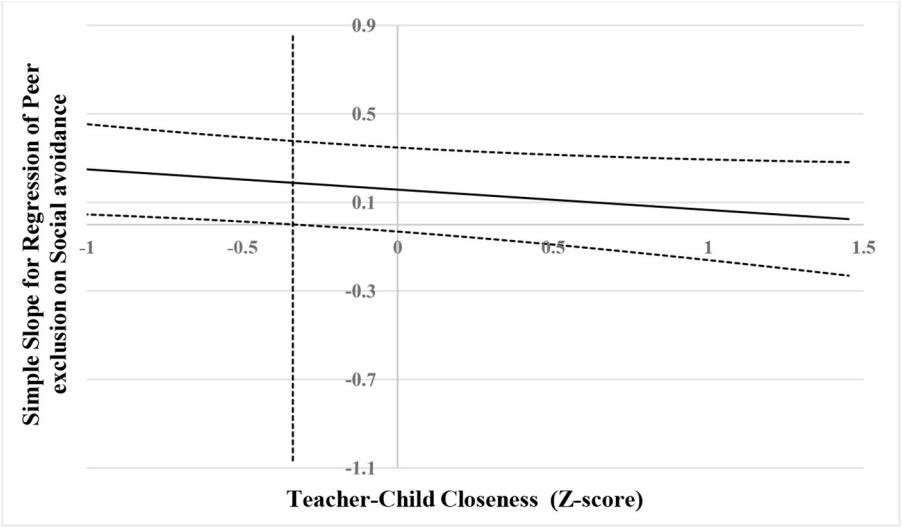


FIGURE 6
Johnson–Neyman regions of significance and confidence bands for mother-rated social avoidance along teacher-rated teacher–child closeness in relation to peer exclusion. The solid diagonal line represents the regression coefficient for social avoidance along teacher–child closeness. Dashed diagonal blue lines are confidence bands—upper and lower bounds of 95% confidence interval for social avoidance regression coefficient along teacher–child closeness. The vertical red dashed line indicates the point along teacher–child closeness at which the social avoidance regression coefficient transitions from statistical significance (left of vertical dashed line) to non-significance (right of vertical dashed line). The value of the vertical red dashed line is −0.34.

future studies exploring mechanisms underlying social avoidance are still needed to further our understanding of how (and under which circumstances) socially avoidant children may be at risk for subsequent social adjustment difficulties.

Limitations and future direction

Several limitations to this study need to be considered. First, the study was cross-sectional, not revealing causality between variables. For example, in terms of our interpretation, it is also possible that migrant preschoolers who have poor peer relationships, in turn, increase their social avoidance. Future studies should use a longitudinal design to explore the interaction between variables better.

Second, because the preschoolers were too young to complete the written questionnaires, all data collection is based on mother and teacher reports, which may be biased. For example, researchers found an association between teachers' negative feelings about relationships with children they perceive as having negative behavior (84). Future studies should conduct multiple sources (e.g., peers and parental reports) for each variable.

Third, the sample of the present study was selected from Shanghai, which could limit generalizing the results to other areas. Future studies need to expand the sample population to better (e.g., different cultural backgrounds and greater socioeconomic diversity). Additionally, a comparison group of non-migrant children who moved into an urban area would also help future studies gain a more comprehensive perspective on the migrant acculturation experience and enhance future studies.

Fourth, we focused on socially avoidant migrant preschoolers, likely affected by contextual factors (85). Other aspects of migrant variables, such as the length of residence of migrant preschoolers in cities and the acculturation of migrant children (i.e., different cultural standards and belief systems), may serve different functions in the adjustment of children with different backgrounds (80). Further research is needed to account for the involvement of context in migrant preschoolers' social adjustment.

Despite these limitations, this research explored the relations between social avoidance and social adjustment in Chinese migrant preschoolers for the first time and found the protective role of teacher–child closeness and the risky role of teacher–child conflict in those relationships. Such findings have practical implications for early intervention programs for socially avoidant migrant preschoolers. Teachers should know that their relationships with children play an important role in migrant preschoolers' early social development. Therefore, practitioners and educators should pay attention to children who avoid social interaction, especially migrant children, give them warmth and support, and help children engage in social relationships.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Shanghai Normal University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

JZ, XY, and XL managed the literature search and analyses. XD and SZ participated in data collection. YL designed the study. All authors contributed to the article and approved the submitted version.

Funding

This study was supported by funding from the National Social Science Fund of China (21CSH048).

Acknowledgments

We are really grateful to the participating children, parents, and teachers who participated in this study.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

1. Rubin KH, Bukowski WM, Bowker JC. *Children in Peer Groups. Handbook of Child Psychology and Developmental Science: Ecological Settings and Processes*. Hoboken, NJ: John Wiley & Sons, Inc. (2015). p. 175–222. doi: 10.1002/9781118963418.childpsy405

2. Asendorpf JB. Beyond social withdrawal: Shyness, unsociability, and peer avoidance. *Hum Dev.* (1990) 33:250–9. doi: 10.1159/000276522

3. Rubin KH, Coplan RJ, Bowker JC. Social withdrawal in childhood. *Annu Rev Psychol.* (2009) 60:141–71. doi: 10.1146/annurev.psych.60.110707.163642

4. Ding X, Zhang W, Ooi LL, Coplan RJ, Zhang S, Dong Q. Longitudinal relations between social avoidance, academic achievement, and adjustment in Chinese children. *J Appl Dev Psychol.* (2022) 79:101385. doi: 10.1016/j.appdev.2021.101385

5. Sette S, Zava F, Baumgartner E, Laghi F, Coplan RJ. Examining links between social withdrawal subtypes and internalizing problems among Italian primary school children. *Eur J Dev Psychol.* (2022) 2022:1–19. doi: 10.1080/17405629.2022.2086118

6. Zhu J, Yin X, Wang G, Jiang Y, Li Y. Social avoidance and social adjustment in Chinese preschool migrant children: The moderating role of household chaos and gender. *Int J Environ Res Public Health.* (2022) 19:16769. doi: 10.3390/ijerph192416769

7. Arbeau KA, Coplan RJ, Weeks M. Shyness, teacher-child relationships, and socio-emotional adjustment in grade 1. *Int J Behav Dev.* (2010) 34:259–69. doi: 10.1177/0165025409350959

8. Hu F, You S, Yu H, Zhou H, Li Y. Effects of preschool children's body mass index on peer relationships: The moderating role of teacher-child relationships. *J Shaanxi Xueqian Normal Univ.* (2023) 39:38–45. doi: 10.11995/j.issn.2095-770X.2023.01.006

9. Chen X, Wang L, Wang Z. Shyness-sensitivity and social, school, and psychological adjustment in rural migrant and urban children in China. *Child Dev.* (2009) 80:1499–513. doi: 10.1111/j.1467-8624.2009.01347.x

10. Liu Z, Zhang X, Zhu M, Li X, Zhang Y. *Survey on Mental Health of Rural Children Left-Behind and in Migration. Blue Book of Mental Health: Report on National Mental Health Development in China (2017–2018)*. Beijing: Social Sciences Academic Press (2019). p. 187–219.

11. Zhang J, Yan L, Yuan Y. Rural-urban migration and mental health of Chinese migrant children: Systematic review and meta-analysis. *J Affect Disord.* (2019) 257:684–90. doi: 10.1016/j.jad.2019.07.069

12. Jin C, Liu Y, Chen L. The effect of negative social environment on problem behavior of unattended and migrated children: Parent-child relationship and peer relationship as moderators. *J Psychol Sci.* (2012) 35:1119–25. doi: 10.16719/j.cnki.1671-6981.2012.05.003

13. Li Y, Xu L, Lv Y, Liu L, Wang Y. The association between mother-child relationship, teacher-child relationship and social adaptive behaviors for preschool migrant children. *Psychol Dev Educ.* (2014) 30:624–34. doi: 10.16187/j.cnki.issn1001-4918.2014.06.009

14. Coplan RJ, Armer M. A "Multitude" of solitude: A closer look at social withdrawal and nonsocial play in early childhood. *Child Dev Perspect.* (2007) 1:26–32. doi: 10.1111/j.1750-8606.2007.00006.x

15. Crozier WR. Shyness and self-esteem in middle childhood. *Br J Educ Psychol.* (1995) 65:85–95. doi: 10.1111/j.2044-8279.1995.tb01133.x

16. Coplan RJ, Ooi LL, Xiao B, Rose-Krasnor L. Assessment and implications of social withdrawal in early childhood: A first look at social avoidance. *Soc Dev.* (2018) 27:125–39. doi: 10.1111/sode.12258

17. Coplan RJ, Prakash K, O'Neil K, Armer M. Do you "want" to play? Distinguishing between conflicted shyness and social disinterest in early childhood. *Dev Psychol.* (2004) 40:244–58. doi: 10.1037/0012-1649.40.2.244

18. Coplan R, Weeks M. Unsociability in middle childhood: Conceptualization, assessment, and associations with socioemotional functioning. *Merrill Palmer Q.* (2010) 56:105–30. doi: 10.1353/mpq.2010.0005

19. Chen X. *Socio-Emotional Development in Chinese Children. The Oxford Handbook of Chinese Psychology. Oxford Library of Psychology*. New York, NY: Oxford University Press (2010). p. 37–52. doi: 10.1093/oxfordhb/9780199541850.013.0005

20. Sette S, Zava F, Baumgartner E, Baiocco R, Coplan RJ. Shyness, unsociability, and socio-emotional functioning at preschool: The protective role of peer acceptance. *J Child Fam Stud.* (2017) 26:1196–205. doi: 10.1007/s10826-016-0638-8

21. Coplan RJ, Rose-Krasnor L, Weeks M, Kingsbury A, Kingsbury M, Bullock A. Alone is a crowd: Social motivations, social withdrawal, and socioemotional functioning in later childhood. *Dev Psychol.* (2013) 49:861–75. doi: 10.1037/a0028861

22. Eggum ND, Zhang L, An D, Xu J, Clifford BN, Costa M. Shyness, unsociability, and social avoidance during early adolescence: Associations with peer relationships and aggression. *J Early Adolesc.* (2022) 42:937–64. doi: 10.1177/02724316221088750

23. Chen X. Culture, temperament, and social and psychological adjustment. *Dev Rev.* (2018) 50:42–53. doi: 10.1016/j.dr.2018.03.004

24. Oh W, Rubin KH, Bowker JC. Trajectories of social withdrawal from middle childhood to early adolescence. *J Abnorm Child Psychol.* (2008) 36:553–66. doi: 10.1007/s10802-007-9199-z

25. Johnson HD, Lavoie JC, Mahoney M. Interparental conflict and family cohesion: Predictors of loneliness, social anxiety, and social avoidance in late adolescence. *J Adolesc Res.* (2001) 16:304–18. doi: 10.1177/0743558401163004

26. Ding X, Coplan RJ, Sang B, Liu J, Pan T, Cheng C. Young Chinese children's beliefs about the implications of subtypes of social withdrawal: A first look at social avoidance. *Br J Dev Psychol.* (2015) 33:159–73. doi: 10.1111/bjdp.12081

27. Coplan RJ, Liu J, Ooi LL, Chen X, Li D, Ding X, et al. Person-oriented analysis of social withdrawal in Chinese children. *Soc Dev.* (2016) 25:794–811. doi: 10.1111/sode.12181

28. Sang B, Ding X, Coplan RJ, Liu J, Pan T, Feng X. Assessment and implications of social avoidance in Chinese early adolescents. *J Early Adolesc.* (2018) 38:554–73. doi: 10.1177/0272431616678988

29. Boelens M, Raat H, Yang-Huang J, Schouten GM, van Grieken A, Jansen W. Independent contributions of family and neighbourhood indicators of socioeconomic status and migrant status to risk of mental health problems in 4-12 year old children. *SSM Popul Health.* (2020) 12:100675. doi: 10.1016/j.ssmph.2020.100675

30. Li C, Jiang S. Social exclusion, sense of school belonging and mental health of migrant children in China: A structural equation modeling analysis. *Child Youth Serv Rev.* (2018) 89:6–12. doi: 10.1016/j.childyouth.2018.04.017

31. Sidhu SS, Vasireddy R. The detention of migrant families. *J Am Acad Child Adolesc Psychiatry*. (2020) 59:681–3. doi: 10.1016/j.jaac.2019.12.011

32. Yang J, Liu X, Zhao F, Wang L, Liu X, Zhou H, et al. The effects of perceived discrimination and city identity on the social adaptation of migrant children in public and private schools. *Stress Health*. (2019) 35:341–9. doi: 10.1002/smi.2869

33. Lin Z, Weng Y. Investigation on the psychological wellbeing of junior middle school student in migrant schools. *Chinese Mental Health J.* (2004) 18:116. Available online at: https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAiTRKgchrJ08w1e7eeyE9jLkqq9ZPlUTIs--3CiKuOtPDfi8yU3xRl7VrFJS908mYoyg8o5EaMwKSTw1&uniplatform=NZKPT

34. Coplan RJ, Arbeau KA, Armer M. Don't fret, be supportive! Maternal characteristics linking child shyness to psychosocial and school adjustment in kindergarten. *J Abnorm Child Psychol*. (2008) 36:359–71. doi: 10.1007/s10802-007-9183-7

35. Ding X, Chen X, Fu R, Li D, Liu J. Relations of shyness and unsociability with adjustment in migrant and non-migrant children in urban China. *J Abnorm Child Psychol*. (2020) 48:289–300. doi: 10.1007/s10802-019-00583-w

36. Liu J, Bowker JC, Coplan RJ, Yang P, Li D, Chen X. Evaluating links among shyness, peer relations, and internalizing problems in Chinese young adolescents. *J Res Adolesc*. (2019) 29:696–709. doi: 10.1111/jora.12406

37. China Women's Federation. *Research Report: Condition of Left-Behind Children in Rural Areas and Migrant Children in Urban Areas in China*. (2013). Available online at: http://www.women.org.cn/allnews/02/3906.html (accessed May 16, 2013).

38. Li Y, Xu L, Lv Y, Liu L, Wang Y, Huntsinger CS. The influence of preschool rural migrant composition on rural migrant children's early development in China. *Int J Intercult Relat*. (2015) 49:121–36. doi: 10.1016/j.ijintrel.2015.08.001

39. Pianta RC, Nimetz SL, Bennett E. Mother–child relationships, teacher–child relationships, and school outcomes in preschool and kindergarten. *Early Child Res Q*. (1997) 12:263–80. doi: 10.1016/S0885-2006(97)90003-X

40. Li L, Valiente C, Eisenberg N, Spinrad TL, Johns SK, Berger RH, et al. Longitudinal associations among teacher–child relationship quality, behavioral engagement, and academic achievement. *Early Child Res Q*. (2022) 61:25–35. doi: 10.1016/j.ecresq.2022.05.006

41. Pianta RC, Steinberg M. *Teacher–Child Relationships and the Process of Adjusting to School. Beyond the Parent: The Role of Other Adults in Children's Lives. New Directions for Child Development, No. 57*. San Francisco, CA: Jossey-Bass (1992). p. 61–80. doi: 10.1002/cd.23219925706

42. Saral B, Acar IH. Preschool children's social competence: The roles of parent–child, parent–parent, and teacher–child relationships. *Eur Early Childh Educ Res J*. (2021) 29:856–76. doi: 10.1080/1350293X.2021.1985557

43. Acar IH, Hong S-Y, Wu C. Examining the role of teacher presence and scaffolding in preschoolers' peer interactions. *Eur Early Childh Educ Res J*. (2017) 25:866–84. doi: 10.1080/1350293X.2017.1380884

44. Hamre BK, Pianta RC. Early teacher-child relationships and the trajectory of children's school outcomes through eighth grade. *Child Dev*. (2001) 72:625–38. doi: 10.1111/1467-8624.00301

45. Hartz K, Williford AP, Koomen HMY. Teachers' perceptions of teacher-child relationships: Links with children's observed interactions. *Early Educ Dev*. (2017) 28:441–56. doi: 10.1080/10409289.2016.1246288

46. Coplan RJ, Liu J, Cao J, Chen X, Li D. Shyness and school adjustment in Chinese children: The roles of teachers and peers. *School Psychol Quart*. (2017) 32:131–42. doi: 10.1037/spq0000179

47. Lu MS, Whittaker JE, Ruzek E, Pianta RC, Vitiello VE. Fostering early motivation: The influence of teacher-child relationships and interactions on motivation in the kindergarten classroom. *Early Educ Dev*. (2022) 2022:1–18. doi: 10.1080/10409289.2022.2055992

48. Silver RB, Measelle JR, Armstrong JM, Essex MJ. The impact of parents, child care providers, teachers, and peers on early externalizing trajectories. *J Sch Psychol*. (2010) 48:555–83. doi: 10.1016/j.jsp.2010.08.003

49. Belsky J, Bakermans-Kranenburg MJ, van IJzendoorn MH. For better and for worse: differential susceptibility to environmental influences. *Curr Dir Psychol Sci*. (2007) 16:300–4. doi: 10.1111/j.1467-8721.2007.00525.x

50. Kagan J, Reznick JS, Snidman N. The physiology and psychology of behavioral inhibition in children. *Child Dev*. (1987) 58:1459–73. doi: 10.2307/1130685

51. Zhu J, Yang T, Weng W, Li Y. Social avoidance and social adjustment among young children: The moderating role of maternal psychological control. *Stud Early Childh Educ*. (2020) 2020:17–29. doi: 10.13861/j.cnki.sece.2020.10.002

52. Collins BA, O'Connor EE, Supplee L. Behavior problems in elementary school among low-income males: The role of teacher-child relationships. *J Educ Res*. (2017) 110:72–84. doi: 10.1080/00220671.2015.1039113

53. Zhu J, Li Y, Zhang Y, Coplan R, Liu T. Shyness and social adjustment among Chinese preschoolers: The moderating role of student-teacher relationships. *J Psychol Sci*. (2018) 2018:1130–7. doi: 10.16719/j.cnki.1671-6981.20180516

54. Baardstu S, Coplan RJ, Eliassen E, Brandlistuen RE, Wang MV. Exploring the role of teacher–child relationships in the longitudinal associations between childhood shyness and social functioning at school: A prospective cohort study. *School Ment Health*. (2022) 14:984–96. doi: 10.1007/s12310-022-09518-1

55. Wu Y, Wu J, Chen Y, Han L, Han P, Wang P, et al. Shyness and school adjustment among Chinese preschool children: Examining the moderating effect of gender and teacher–child relationship. *Early Educ Dev*. (2015) 26:149–66. doi: 10.1080/10409289.2015.970503

56. Bowlby J. *Attachment and Loss. Vol. 2: Separation: Anxiety and Anger*. New York, NY: Basic Books (1973).

57. Verschueren K, Koomen HMY. Teacher-child relationships from an attachment perspective. *Attach Hum Dev*. (2012) 14:205–11. doi: 10.1080/14616734.2012.672260

58. Coplan RJ, Baldwin D, Wood KR. Shy but getting by: Protective factors in the links between childhood shyness and socio-emotional functioning. In: LA Schmidt, KL Poole, editors, *Adaptive Shyness: Multiple Perspectives on Behavior and Development*. Cham: Springer International Publishing (2020). p. 63–87. doi: 10.1007/978-3-030-38877-5_4

59. Li Y, Zhu J-J, Coplan RJ, Gao Z-Q, Xu P, Li L, et al. Assessment and implications of social withdrawal subtypes in young Chinese children: The Chinese version of the child social preference scale. *J Genet Psychol*. (2016) 177:97–101. doi: 10.1080/00221325.2016.1174100

60. Zhu J, Xiao B, Hipson W, Yan C, Coplan RJ, Li Y. Social avoidance and social adjustment: The moderating role of emotion regulation and emotion lability/negativity among Chinese preschool children. *Front Psychol*. (2021) 12:618670. doi: 10.3389/fpsyg.2021.618670

61. Pianta RC. *STRS Student-Teacher Relationship Scale: Professional Manual*. Odessa: Psychological Assessment Resources (2001).

62. Zhang X. Reliability and validity of teacher-child relationships scale. *Chin J Clin Psychol*. (2010) 18:582–3. doi: 10.16128/j.cnki.1005-3611.2010.05.021

63. Ladd GW, Profilet SM. The child behavior scale: A teacher-report measure of young children's aggressive, withdrawn, and prosocial behaviors. *Dev Psychol*. (1996) 32:1008–24. doi: 10.1037/0012-1649.32.6.1008

64. Zhu J, Wang Y, Li Y. Reliability and validity of the child behavior scale in Chinese preschoolers. *Chin J Clin Psychol*. (2017) 2017:910–3. doi: 10.16128/j.cnki.1005-3611.2018.05.016

65. Hayes AF. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach, 3rd Edn*. New York, NY: The Guilford Press (2022).

66. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav Res Methods*. (2008) 40:879–91. doi: 10.3758/BRM.40.3.879

67. Aiken LS, West SG, Reno RR. *Multiple Regression: Testing and Interpreting Interactions*. (2018). New York, NY: SAGE.

68. Johnson PO, Fay LC. The Johnson-Neyman technique, its theory and application. *Psychometrika*. (1950) 15:349–67. doi: 10.1007/BF02288864

69. Hayes AF, Matthes J. Computational procedures for probing interactions in OLS and logistic regression: SPSS and SAS implementations. *Behav Res Methods*. (2009) 41:924–36. doi: 10.3758/BRM.41.3.924

70. Taylor C. *A Secular Age*. Cambridge, MA: Harvard University Press (2007). p. 874.

71. Wang C, Chu Z. The impact of the sense of family belonging on migrant children's academic performance: The mediating effect of parent-child conflicts. *Chin J Special Educ*. (2019) 4:61–8. Available online at: https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAiTRKibYlV5Vjs7iLik5jEcCI09uHa3oBxtWoJL5VR2nm57AdkEhFM7NSr7LIsZOAJUfFPmteWpjaJhy&uniplatform=NZKPT

72. Lerner RM. A "goodness of fit" model of person-context interaction. *Hum Dev*. (1983) 279:294.

73. Ellis WE, Zarbatany L. Peer group status as a moderator of group influence on children's deviant, aggressive, and prosocial behavior. *Child Dev*. (2007) 78:1240–54. doi: 10.1111/j.1467-8624.2007.01063.x

74. Liu C, Wu X. Move or stay: Education for children of migrant workers. *China Youth Res*. (2007) 7:5–8. doi: 10.19633/j.cnki.11-2579/d.2007.07.002

75. Sette S, Baumgartner E, Schneider BH. Shyness, child–teacher relationships, and socio-emotional adjustment in a sample of Italian preschool-aged children. *Infant Child Dev*. (2014) 23:323–32. doi: 10.1002/icd.1859

76. Davies PT, Cummings EM. Marital conflict and child adjustment: An emotional security hypothesis. *Psychol Bull*. (1994) 116:387–411. doi: 10.1037/0033-2909.116.3.387

77. Bandura A. *Social Learning Theory*. Oxford: Prentice-Hall (1977). p. 247.

78. Fuligni AJ, Zhang W. Attitudes toward family obligation among adolescents in contemporary urban and rural China. *Child Dev*. (2004) 75:180–92. doi: 10.1111/j.1467-8624.2004.00662.x

79. Chen X, Li D, Liu J, Fu R, Liu S. Father migration and mother migration: Different implications for social, school, and psychological adjustment of left-behind children in rural China. *J Contempor China.* (2019) 28:849–63. doi: 10.1080/10670564.2019.1594100

80. Chen X, Fu R, Li D, Liu J, Liu S, Cui L. Acculturation and adjustment among rural migrant children in urban China: A longitudinal study. *Appl Psychol.* (2021) 13:559–77. doi: 10.1111/aphw.12264

81. Bowlby J. Attachment and loss: Retrospect and prospect. *Am J Orthopsychiatry.* (1982) 52:664–78. doi: 10.1111/j.1939-0025.1982.tb01456.x

82. Liew J, Valiente C, Hernández MM, Abera DE. Emotional self-regulation and reactivity, school-based relationships, and school engagement and achievement. *SAGE Handb Dev Psychol Early Childh Educ.* (2019) 2019:42–62. doi: 10.4135/9781526470393.n3

83. Huang H, Wang X. The effect of family socioeconomic status on migrant preschool children's problem behaviors: The chain mediating role of family resilience and child-parent relationship. *J Psychol Sci.* (2022) 45:315–22. doi: 10.16719/j.cnki.1671-6981.20220207

84. Stuhlman MW, Pianta RC. Teachers' narratives about their relationships with children: Associations with behavior in classrooms. *School Psych Rev.* (2002) 31:148–63. doi: 10.1080/02796015.2002.12086148

85. Shi L, Chen W, Bouey JH, Lin Y, Ling L. Impact of acculturation and psychological adjustment on mental health among migrant adolescents in Guangzhou, China: A cross-sectional questionnaire study. *Br Med J Open.* (2019) 9:e022712. doi: 10.1136/bmjopen-2018-022712

frontiers | Frontiers in Psychiatry

TYPE Original Research
PUBLISHED 08 June 2023
DOI 10.3389/fpsyt.2023.1168342

OPEN ACCESS

EDITED BY
Jingjing Zhu,
Shanghai Normal University, China

REVIEWED BY
Irina Jarvers,
University of Regensburg, Germany
Stefania Sette,
Sapienza University of Rome, Italy

*CORRESPONDENCE
Junsheng Liu
✉ jsliu@psy.ecnu.edu.cn

RECEIVED 17 February 2023
ACCEPTED 22 May 2023
PUBLISHED 08 June 2023

CITATION
Hu Y, Bullock A, Zhou Y and Liu J (2023) Moderating effect of classroom sociable norm on the relations between unsociability and internalizing problems in Chinese adolescents. *Front. Psychiatry* 14:1168342. doi: 10.3389/fpsyt.2023.1168342

Moderating effect of classroom sociable norm on the relations between unsociability and internalizing problems in Chinese adolescents

Yihao Hu[1], Amanda Bullock[2], Ying Zhou[3] and Junsheng Liu[1,4]*

[1]School of Psychology and Cognitive Science, East China Normal University, Shanghai, China, [2]Department of Psychology, Carleton University, Ottawa, ON, Canada, [3]China Executive Leadership Academy Pudong, Pudong, China, [4]Shanghai Changning Mental Health Center, Shanghai, China

Objectives: The goal of the present study was to examine the moderating effect of classroom sociable norm on the relations between unsociability and internalizing problems (the indicators included depression, loneliness and self-esteem) in Chinese adolescents.

Methods: Participants were *N*=1,160 adolescents in Grade 4–8 from Shanghai, People's Republic of China. They completed questionnaires about unsociability, sociability, and social preference via peer nominations, while depression, loneliness, and self-esteem were collected via self-report.

Results: It was found that unsociability was positively associated with depression and loneliness, and negatively associated with self-esteem. Moreover, the relations between unsociability and indicators of internalizing problems were moderated by classroom sociable norm. More specifically, the significant positive associations between unsociability and depression and loneliness were stronger in classrooms with high sociable norm, and the negative association between unsociability and self-esteem was only significant in such classrooms.

Conclusion: The findings suggest that classroom sociable norm plays an important role in unsociable adolescents' psychological adjustment in China. Researchers should focus more on the influence of classroom environment on adolescents' development in future.

KEYWORDS

unsociability, internalizing problems, adolescents, classroom sociable norm, moderating effect

Introduction

Unsociability is defined as the non-fearful preference for solitary activities (1). Previous research has postulated that unsociability may be particularly problematic for early adolescence since this is a developmental period in which social norms and expectations about peer interactions are strongly emphasized (2). Indeed, studies have shown that unsociable adolescents experience poor psychosocial adjustment such as internalizing problems (3, 4) and peer difficulties (5–8) as compared to other peers. As such, it is not surprising that researchers have focused their attention on elucidating the factors that could exacerbate or attenuate the relations between unsociability and adolescents' adjustment (9–11). In the present study, we focused on the role of classroom, an

important microsystem for adolescents' development (12). Specifically, we examined the moderating effect of classroom sociable norm on the relations between unsociability and internalizing problems among Chinese adolescents.

Links between unsociability and internalizing problems in Chinese adolescents

According to the approach-avoidance motivation model of social withdrawal, unsociable adolescents have both low approach motivation and low avoidance motivation in social situations (13). That is, they do not seek social interactions, but they do not fear or avoid it. Instead, it appears that unsociable individuals prefer to spend time alone (1). In previous research, other terms which had similar meanings to unsociability have also been used, including preference for solitude (14), social disinterest (15) and affinity for aloneness (16).

Although unsociability may be associated with poor adjustment such as loneliness in other countries (17), unsociable adolescents are thought to be at a higher risk for adjustment problems in China than in western countries, given the collectivistic nature of Chinese society that encourages and emphasizes group harmony, cohesion, and interdependence (18). More specifically, adolescents who prefer to spend time alone may be perceived by peers and adults as selfish as their behavior deviates from the social norm in China (19). Indeed, there is a growing body of research that has shown that unsociable Chinese adolescents face internalizing issues such as depression and loneliness (5, 6, 20). For example, a study in China found that unsociability contributed to poorer psychological adjustment (including higher depression, higher loneliness, and lower self-worth) in Chinese children (3). A previous study has found that the group size of unsociable adolescents was not small in China, accounting for about 14.6% of total Chinese adolescents (21), therefore it is important to find protective factors for their psychological adjustment.

The role of classroom norm on adolescents' adjustment

Classroom norm refers to either what is commonly done, or what is commonly approved or socially sanctioned in the classroom (22). Specifically, norm salience in the classroom is the extent to which classmates express their attitude toward a type of behavior by virtue of reactions to peers who do it, such as rejection and popularity (23). Compared to descriptive norm or injunctive norm, that is, what most people do or what people are expected to do (23), norm salience of behavior may have a stronger association with peer influence on adolescents' behavior in the classroom (24).

Previous studies have indicated that norm salience of different behaviors such as bullying (25) and defending (26) in the classroom had an impact on adolescents' adjustment. For example, it was found that in classrooms where bullying was more rejected, the behavior of defending was more prevalent and popular (25). Moreover, the findings in a previous study indicated that adolescents would have better perceptions of classroom climate and feelings of belonging in classrooms where defending was more popular (26). Therefore, based on these findings, it appears that norm salience may be a key factor in adolescents' adjustment.

Moderating role of classroom sociable norm on unsociable adolescents' internalizing problems

Although there have been studies exploring possible moderators on relations between adolescents' unsociability and adjustment difficulties, previous researchers have focused more on individual-level variables, such as parenting behavior (11), behavioral control (27), insecure attachment (9) and others' support (28). According to the goodness of fit theory (29), babies would have better development when their temperament was a good match for their parents' parenting behavior. As an extrapolation of this theory, we could speculate that individual's characteristic would be associated with different developmental outcomes in different environments (2). There have been studies indicating that the characteristics of the environment would exert influence on unsociable adolescents' adjustment, either their groups (30) or their classrooms (31). For example, a study found that solitary play was negatively associated with social preference only in high-interactive groups, that is, where the group members had more social interactions with others (30). Moreover, another study reported that unsociability only positively predicted peer victimization in classrooms with a low prevalence of unsociability (31).

However, the above two research focused on the role of prevalence of behavior, that is, the descriptive norm in the group or classroom. In terms of norm salience, only one study found that norm salience of social withdrawal or aggression moderated the association between social withdrawal and peer victimization (32). According to the reputational salience hypothesis (33), behavior which is popular in a group would become "reputationally salient." As early adolescence is an important period in which to establish status hierarchy (34), it is possible for adolescents to adopt behaviors which are popular to get status and then acquire material or social resources in the classroom (35). Indeed, there have been studies indicating that adolescents would adopt more behaviors popular in their classrooms for the purpose of improving their status, such as aggressive behavior (36) and prosocial behavior (37).

Previous studies indicated that time spent with peers continues increasing from middle childhood to late adolescence (38), therefore sociability may be more important for adolescents than children. However, there has been no study exploring the effect of norm salience of sociability (hereinafter referred to as "classroom sociable norm"). Based on the findings of previous research (36, 37), it could be speculated that in classrooms with high sociable norm, that is, classrooms in which sociability is more popular, adolescents would tend to have more social interactions with others to acquire popularity for themselves (35). For unsociable adolescents who prefer to participate in solitary activities (1), their behavior may be different from other classmates' in classrooms with high sociable norm. According to the Theory of Social Comparison (39), people would evaluate their own opinions or abilities in comparisons with others. As a result of comparisons, unsociable adolescents may feel upset and regard themselves as incompetent in classrooms with a high sociable norm and subsequently have more internalizing problems. Moreover, according to the Individual-Group Similarity Model (40), people whose behaviors deviated from the group norms would be rejected by other members in the group. Therefore, unsociable adolescents may be more excluded or rejected in classrooms with high sociable norm, and then their poor peer relationships may contribute to more internalizing problems (3, 41).

The current study

Previous research has found that the links between unsociability and internalizing problems might be strongest in early adolescence, a period when social norms and expectations about peer interactions are emphasized (2). Indeed, peer interactions are increasingly important from childhood to adolescence (38) and it is important for adolescence to strive for status in their classrooms (34). As a result, exploring the role of classroom sociable norm on adolescents' adjustment is warranted. Our aim was to explore the moderating effect of classroom sociable norm on relations between adolescents' unsociability and internalizing problems in China. We chose depression, loneliness, and self-esteem, which were representative indices of psychological adjustment (3) as dependent variables in the current study. Because social preference was highly correlated with popularity in China (42) and it is difficult to find a term in Chinese that directly corresponds to popularity in English (43), we used social preference as the index of status for the calculation of classroom sociable norm.

The following hypotheses were put forward. First, it was hypothesized that Chinese adolescents' unsociability would be significantly associated with internalizing problems. More specifically, higher unsociability would be associated with higher depression, higher loneliness, and lower self-esteem. Second, it was hypothesized that classroom sociable norm would significantly moderate the relations between unsociability and internalizing problems. More specifically, the relations between unsociability and internalizing problems would be stronger in classrooms with higher sociable norm.

Given that the associations between unsociability and adjustment may be different across gender (44) or developmental stages (2), we included gender and grade as control variables. In addition, previous research has indicated that class size and proportion of boys in the classroom might also influence adolescents' adjustment (45). As such, we also controlled for the main effect of these two variables.

Method

Participants

We recruited participants from four public schools, including two primary schools and two secondary schools in Shanghai, People's Republic of China. A total of $N = 1{,}160$ students participated in the study (including 569 boys, $M_{age} = 11.69$ years, $SD = 1.60$ years), including those in Grades 4 ($n = 264$; $M_{age} = 9.84$ years, $SD = 7.30$ months), 5 ($n = 283$; $M_{age} = 10.83$ years, $SD = 6.80$ months), 6 ($n = 213$; $M_{age} = 11.91$ years, $SD = 9.27$ months), 7 ($n = 179$; $M_{age} = 12.84$ years, $SD = 8.92$ months) and 8 ($n = 221$; $M_{age} = 13.81$ years, $SD = 8.82$ months) respectively.

There were 39 classes in total (including 9 classes in Grade 4, 9 classes in Grade 5, 7 classes in Grade 6, 6 classes in Grade 7 and 8 classes in Grade 8), with approximately 30 students in each class on average. Almost 100% of adolescents belonged to Han nationality, the predominant nationality (over 90% of the population) in China (46). All participating students assented to this study and acquired consent from their own parents before data collection. 92% of participants were from intact families, and about 47% of fathers and 42% of mothers had a college or higher education.

Procedure

The design of the current study was reviewed and approved by the institutional review board of East China Normal University. Written informed consent were obtained from participating students and their parents before data collection. Adolescents with parental consent who agreed to participate were arranged to finish the questionnaire during school hours within their own classrooms. During data collection, each adolescent reported their level of depression, loneliness and self-esteem by self-report measures, and they were also provided a class list to finish peer-nomination assessments, including unsociability, sociability and social preference. The process of data collection was carried out by well-trained graduate research assistants, and the duration of it was about 40 min. In order to protect adolescents from potential negative influence during the data collection, we told them that all of their answers would only be used for research and kept confidential, and they could seek help from our team or psychology teachers in their schools if they needed it. Each participating student received a pen and a notebook as rewards after finishing the questionnaires.

Measures

Unsociability and sociability

Adolescents' unsociability and sociability were measured using the *Revised Class Play* (RCP) (47, 48) via peer nominations. There are four items for unsociability (e.g., "Someone who prefers playing alone." "Someone who has no interest in group activities.") and four items for sociability (e.g., "Someone who has many friends." "Someone who likes playing with others.") respectively. Adolescents could nominate up to three classmates on each item. According to previous researcher's suggestion (49), both same-sex and cross-sex nominations were allowed. For each adolescent, the nominations they received on each item were standardized within classroom and summed for unsociability and sociability respectively, and then the total score was standardized within classroom again. The reliability and validity of this measure have been shown in Chinese adolescents (44). In the current study, the internal consistency of this measure was $\alpha = 0.89$ for unsociability and $\alpha = 0.88$ for sociability.

Social preference

Following the procedure of previous studies (50), each adolescent was asked to nominate up to three classmates whom they most liked to be with and up to three classmates whom they least like to be with, respectively. Both same-sex and cross-sex nominations were allowed, and then adolescents' nominations received on each item were standardized within classroom. Social preference was computed by subtracting the standardized score of "like least" from the standardized score of "like most," and then the total score was standardized within classroom again. This procedure has been demonstrated to be valid in Chinese adolescents (51).

Depression

Adolescents' depression was measured by self-report using the Chinese version of the *Children's Depression Inventory* (CDI) (52). There were 14 items assessing adolescents' depressive mood, and each adolescent chose one sentence which best described himself or herself

in the past two weeks from the three sentences on each item (e.g., "I am occasionally unhappy." "I am often unhappy." "I am usually unhappy."). The items were answered by using a 3-point scale, with a higher average score of all items indicating a higher level of depression. This measure has been shown to be reliable and valid in Chinese samples (53). In the current study, the internal consistency of this measure was $\alpha = 0.85$.

Loneliness

Adolescents' loneliness was measured by self-report using the Chinese version of a self-report scale adapted from previous studies (54). It included 16 items (e.g., "I feel lonely." "It is hard for me to make friends."), rated on a 5-point scale, with a higher average score of all the items indicating a higher level of loneliness. The reliability and validity of this measure has been demonstrated in Chinese adolescents (20). In the current study, the internal consistency of this measure was $\alpha = 0.92$.

Self-esteem

Adolescents' self-esteem was measured using a self-report general self-esteem subscale adapted from the *Self-Perception Profile for Children* (SPPC) (55). There were 6 items in total (e.g., "I like myself." "I am very confident in myself.") and adolescents responded to them on a 5-point scale, with higher average score of all items indicating higher level of self-esteem. This measure has been shown to be reliable and valid in Chinese adolescents (56). In the current study, the internal consistency of this measure was $\alpha = 0.82$.

Classroom sociable norm

Based on the definition of norm salience (23) and procedure in previous research (32), the classroom sociable norm for each class was acquired by calculating the Pearson correlation coefficient between the scores of sociability and social preference within the classroom. A higher value of classroom sociable norm indicated that sociability was more preferred in the classroom.

Data analysis

Data analysis was conducted using IBM SPSS for Windows (version 25) and *Mplus* version 7.4 (57). To test the hypotheses, we analyzed the data collected in the current study in the following steps. To begin with, for the descriptive statistics, the correlations among individual-level variables, including unsociability, sociability, social preference, depression, loneliness and self-esteem, and among classroom-level variables, including classroom sociable norm, class size, and proportion of boys in the classroom were calculated. Moreover, multivariate analysis of variance (MANOVA) and t-tests of individual-level variables on gender (boys = 0, girls = 1) and grade (primary school = 0, secondary school = 1) were also conducted.

Next, the multilevel models were employed to examine the moderating effect of classroom sociable norm. The unconditional models, the individual-level models and the classroom-level models for depression, loneliness and self-esteem were examined in *Mplus* 7.4, respectively. First, the dependent variables were included in the unconditional models to examine the between-group variation of them. Second, unsociability, gender, and the interaction of them were added into the individual-level models, to examine the main effect of unsociability on internalizing problems. Third, all classroom-level variables and the interactions of unsociability-grade and unsociability-classroom sociable norm were added into classroom-level models, to examine the moderating effect of classroom sociable norm. Simple slope test was conducted if any significant moderating effect was found (58). Gender and all classroom-level variables were grand-mean centered in the data analysis. Missing data were handled using the full information maximum likelihood method (59) with the MLR estimation in *Mplus* 7.4. The equation of the models is presented below (i = student, j = classroom, e and u were random effects).

Individual-level:

$$\text{Depression / Loneliness / Self} - \text{esteem} = \beta_{0j} + \beta_{1j}{}^{*}\text{Unsociability} + \beta_{2j}{}^{*}\text{Gender} + \beta_{3j}{}^{*}\left(\text{Unsociability}{}^{*}\text{Gender}\right) + e_{ij}$$

Classroom-level:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}{}^{*}\text{Classroom sociable } \textit{norm} + \gamma_{02}{}^{*}\text{Grade} + \gamma_{02}{}^{*}\text{Class size} + \gamma_{03}{}^{*}\text{Proportion of boys} + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}{}^{*}\text{Classroom sociable } \textit{norm} + \gamma_{12}{}^{*}\text{Grade} + u_{1j}$$

Results

Missing data

There was no missing data on variables acquired via peer nominations, but on depression, loneliness and self-esteem, which were self-reported, the percentage of missing data was all 2.2%. The result of Little's MCAR test (60) indicated that χ^2 (2169) = 2960.29, $p < 0.001$, which meant that data were not missing at random. However, according to the criterion stipulated in previous research (61), $\chi^2/df = 1.36 < 2$, it was surmised that the data were missing completely at a random pattern.

Descriptive statistics

Means and standard deviations for, and intercorrelations among individual-level or classroom-level study variables are shown in Table 1. For individual-level variables, there were significant positive correlations between unsociability and depression and loneliness, and significant negative correlations between unsociability and sociability, social preference, and self-esteem. For classroom-level variables, there was no significant correlation between each other.

The results of the MANOVA revealed that the main effect of gender was significant, Wilk's $\lambda = 0.96$, F (6, 1,124) = 7.85, $p < 0.001$, $\eta^2 = 0.04$; the main effect of grade was significant, Wilk's $\lambda = 0.92$, F (6, 1,124) = 15.46, $p < 0.001$, $\eta^2 = 0.08$; and the interactive effect of gender-grade was significant, Wilk's $\lambda = 0.98$, F (6, 1,124) = 15.46, $p < 0.01$, $\eta^2 = 0.02$. In the follow-up analysis of variance, gender had a significant

10.3389/fpsyt.2023.1168342

TABLE 1 Descriptive statistics of study variables.

	1	2	3	4	5	6
Individual-level variables						
1 Unsociability						
2 Sociability	−0.17***					
3 Social preference	−0.33***	0.41***				
4 Depression	0.22***	−0.20***	−0.27***			
5 Loneliness	0.30***	−0.26***	−0.33***	0.69***		
6 Self-esteem	−0.12***	0.14***	0.16***	−0.58***	−0.53***	
M	0.02	0.03	0.00	1.41	1.92	3.44
SD	1.00	0.99	0.98	0.34	0.73	0.81
Classroom-level variables						
1 Classroom sociable norm						
2 Class size	−0.17					
3 Proportion of boys	−0.15	−0.06				
M	0.42	29.74	0.49			
SD	0.16	3.91	0.06			

***$p < 0.001$.

TABLE 2 The means and standard deviations of individual-level variables ($M \pm SD$).

	Primary school		Secondary school	
	Boys	Girls	Boys	Girls
Unsociability	0.08 ± 0.96	−0.05 ± 1.03	0.01 ± 0.92	0.04 ± 1.09
Sociability	−0.15 ± 0.81	0.13 ± 1.09	0.00 ± 0.97	0.11 ± 1.03
Social preference	−0.25 ± 1.06	0.22 ± 0.86	−0.12 ± 1.00	0.13 ± 0.95
Depression	1.40 ± 0.34	1.28 ± 0.29	1.49 ± 0.35	1.47 ± 0.35
Loneliness	1.85 ± 0.73	1.65 ± 0.66	2.14 ± 0.74	2.02 ± 0.70
Self-esteem	3.48 ± 0.82	3.72 ± 0.76	3.34 ± 0.83	3.24 ± 0.76

effect on sociability (F (1, 1,156) = 10.86, $p < 0.01$), social preference (F (1, 1,156) = 40.48, $p < 0.001$), depression (F (1, 1,131) = 12.38, $p < 0.001$) and loneliness (F (1, 1,131) = 13.36, $p < 0.001$). Grade had a significant effect on depression (F (1, 1,131) = 48.42, $p < 0.001$), loneliness (F (1, 1,131) = 60.78, $p < 0.001$) and self-esteem (F (1, 1,131) = 43.06, $p < 0.001$). There were significant interaction effects of gender and grade on depression (F (1, 1,131) = 5.32, $p < 0.05$) and self-esteem (F (1, 1,131) = 12.71, $p < 0.001$). The means and standard deviations for individual-level study variables for different gender and grade are shown in Table 2.

Multilevel model

The unconditional models

The intraclass correlations (ICC) of depression, loneliness, and self-esteem were 0.085, 0.078 and 0.081, respectively. According to the ICCs and class size, the design effect of depression, loneliness, and self-esteem were 3.47, 3.26, and 3.35 respectively, all of which were above 2.0, indicating that there was a need for multilevel modeling in the data analysis (62).

The individual-level models

Random slope models for depression, loneliness, and self-esteem were all examined. As shown in Table 3, unsociability had significant positive relations with depression ($b = 0.074$, $SE = 0.011$, $p < 0.001$) and loneliness ($b = 0.218$, $SE = 0.026$, $p < 0.001$), and a significant negative relation with self-esteem ($b = -0.096$, $SE = 0.027$, $p < 0.001$) after controlling for gender and the interaction of unsociability and gender.

The classroom-level models

Classroom-level models for depression, loneliness and self-esteem were examined, respectively. As shown in Table 4, for depression, it had a trend of negative relation with classroom sociable norm ($b = -0.157$, $SE = 0.089$, $p = 0.078$). There was a trend of moderating effect of classroom sociable norm on the association between unsociability and depression ($b = 0.118$, $SE = 0.064$, $p = 0.063$), and the simple slope test (see Figure 1A) showed that unsociability had a more positive relation with depression in classrooms with a high sociable norm (z score of classroom sociable norm = +1) ($b = 0.093$, $SE = 0.015$, $p < 0.001$) than in classrooms with a low sociable norm (z score of classroom sociable norm = −1) ($b = 0.055$, $SE = 0.014$, $p < 0.001$). As for loneliness, there was a trend of moderating effect of grade on the association between unsociability and it ($b = 0.087$, $SE = 0.044$, $p = 0.050$), and the simple slope test showed that unsociability had a more positive relation with loneliness in secondary schools ($b = 0.258$, $SE = 0.029$, $p < 0.001$) than in primary schools ($b = 0.172$, $SE = 0.035$, $p < 0.001$). The interaction of unsociability and classroom sociable norm on loneliness was also significant ($b = 0.413$, $SE = 0.202$, $p = 0.041$), and the simple slope test (see Figure 1B) showed that unsociability had a more positive relation with loneliness in classrooms with a high sociable norm ($b = 0.284$, $SE = 0.041$, $p < 0.001$) than in classrooms with a low sociable norm ($b = 0.153$, $SE = 0.038$, $p < 0.001$). As for self-esteem, the interaction of unsociability and classroom sociable norm was also significant ($b = -0.445$, $SE = 0.176$, $p = 0.012$), and the simple slope test (see Figure 1C) showed that unsociability had a significant negative relation with self-esteem in

TABLE 3 The individual-level models of unsociability on internalizing problems.

	Depression		Loneliness		Self-esteem	
	b	*SE*	*b*	*SE*	*b*	*SE*
Intercept	1.409***	0.019	1.919***	0.039	3.441***	0.043
Unsociability	0.074***	0.011	0.218***	0.026	−0.096***	0.027
Gender	−0.067**	0.021	−0.155***	0.043	0.066	0.052
Unsociability × Gender	−0.021	0.025	−0.014	0.051	−0.027	0.052
Random effect						
Residual	0.099***	0.006	0.428***	0.024	0.585***	0.033
Intercept	0.010***	0.003	0.043***	0.012	0.054**	0.016
Slope	0.001	0.001	0.011*	0.005	0.008	0.007

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

TABLE 4 The classroom-level models of unsociability on internalizing problems.

	Depression		Loneliness		Self-esteem	
	b	*SE*	*b*	*SE*	*b*	*SE*
Intercept	1.410***	0.014	1.919***	0.027	3.440***	0.034
Individual-level						
Unsociability	0.074***	0.011	0.219***	0.023	−0.094***	0.024
Gender	−0.063**	0.021	−0.147**	0.044	0.054	0.053
Unsociability × Gender	−0.019	0.024	−0.003	0.048	−0.047	0.058
Classroom-level						
Grade	0.135***	0.030	0.378***	0.058	−0.323	0.074
Class size	0.001	0.004	0.009	0.008	−0.004	0.009
Proportion of boys	0.016	0.328	−0.746	0.534	0.317	0.688
Classroom sociable norm	−0.157†	0.089	−0.023	0.167	0.208	0.256
Cross-level						
Unsociability × Grade	0.012	0.020	0.087†	0.044	−0.013	0.047
Unsociability × Norm	0.118†	0.064	0.413*	0.202	−0.445*	0.176
Random effect						
Residual	0.099***	0.006	0.426***	0.024	0.585***	0.033
Intercept	0.004**	0.001	0.016*	0.007	0.028*	0.011
Slope	0.001	0.001	0.008	0.005	0.003	0.005

†$p < 0.10$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

classrooms with a high sociable norm ($b = -0.165$, $SE = 0.036$, $p < 0.001$) but not in classrooms with a low sociable norm ($b = -0.024$, $SE = 0.038$, *ns*).

Discussion

The main goal of current study was to examine the moderating effect of classroom sociable norm on the relations between unsociability and internalizing problems among Chinese adolescents. Our hypotheses were supported by the results. Unsociability was associated with higher levels of depression and loneliness as well as a lower level of self-esteem. In addition, the analyses of multilevel models indicated that the effects of unsociability on internalizing problems were stronger in classrooms with a high sociable norm. More specifically, the significant positive associations between unsociability and depression and loneliness were stronger in classrooms with a high sociable norm, and the negative association between unsociability and self-esteem was only significant in classrooms with a high sociable norm.

Regarding the relations between unsociability and indicators of internalizing problems, the results in current study were consistent with those from previous research conducted in contemporary Chinese societies (5, 44). More specifically, unsociability was significantly and positively related to depression and loneliness, but significantly and negatively related to self-esteem in the current sample. Influenced by the traditional Chinese culture, getting along well with others has been emphasized in China for thousands of years

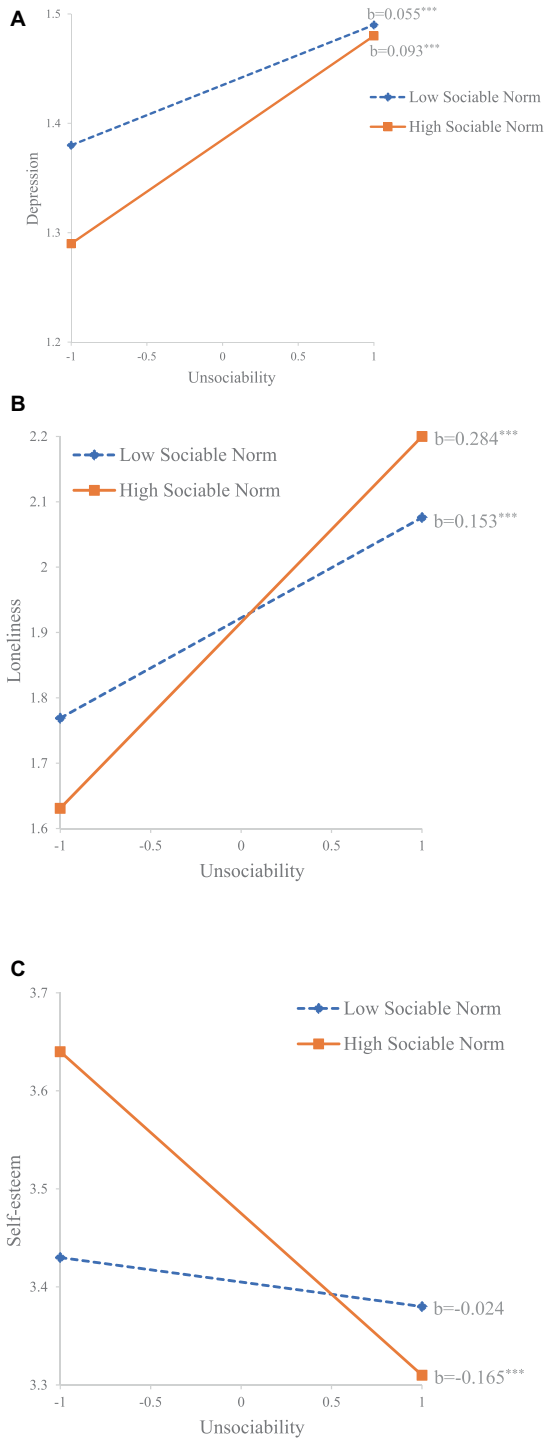


FIGURE 1
The moderating effect of classroom sociable norm on the relationships between unsociability and internalizing problems: **(A)** Depression; **(B)** Loneliness; **(C)** Self-esteem. *p<0.05; **p<0.01; ***p<0.001.

(18), even in Shanghai, which is a large modern city of China. There were two possible mechanisms explaining the negative influence of unsociability on adolescents' mental health. To begin with, spending time alone may be viewed as selfish and indifferent under the background of collectivism (19). Therefore unsociable adolescents would likely be rejected or disliked by their peers, contributing to their internalizing problems (3). Additionally, because unsociable adolescents prefer to spend time alone (63), they may have concerns about their own social competence and have lower self-efficacy on social interactions, which would lead to later internalizing problems.

For the moderating effect of classroom sociable norm, we found that the associations between unsociability and internalizing problems were stronger in classrooms with a high sociable norm. More specifically, unsociable adolescents were more likely to have higher levels of depression or loneliness, or a lower level of self-esteem in classrooms where sociability was more preferred. Based on the reputational salience hypothesis (33) and the theory of resource control (35), social behavior would allow one to earn a reputation for oneself in classrooms with a high sociable norm, and students may tend to adopt it in order to enhance their own status in the classroom. From this perspective, unsociable adolescents may feel incompatible with the whole classroom climate since they prefer participating in solitary activities (1). Moreover, according to the Optimal Distinctiveness Model (64), individuals have both needs for assimilation and differentiation from others in the group. Therefore, unsociable adolescents would feel that they were too unique in classrooms with a high sociable norm and their need for assimilation would not be satisfied. As a consequence, they may have been deprived of a sense of belonging which may explain why they would feel lonely in such a classroom.

Furthermore, according to the Individual-Group Similarity Model (40), other students in classrooms with a high sociable norm may reject or even victimize adolescents who displayed unsociable behavior (31, 32). However, because everyone has interpersonal needs such as inclusion, affection and control (65), it could be speculated that unsociable adolescents would feel upset in classrooms with high sociable norm since their interpersonal needs were not met from their classmates. This in turn, could result in emotional disturbance to develop such as depressed mood. Moreover, they might suspect that their self-worth was low after they lost a sense of control in their interpersonal relationships, which might explain why they had a lower level of self-esteem in such a classroom climate.

Taken together, the present study is the first to provide insight on the moderating role of classroom sociable norm in the relations between adolescents' unsociability and internalizing problems. Nevertheless, there are several limitations that could be addressed in future research. First, our study was cross-sectional in nature, thereby making it challenging to draw causal inferences about the direction of effects that were found. Therefore, it is recommended that future researchers conduct longitudinal studies to explore the timing effect further. Second, unsociability is characterized as both low motivation of approach and low motivation of avoidance (13), but it was measured using peer nominations in the current study. Therefore, it could be questioned whether the measure of unsociability accurately reflected the internal state of adolescents. Researchers could measure unsociability by self-report in the future, which might reveal participants' motivations better. Third, our sample was from Shanghai, a modern city in China. Future researchers could consider exploring the moderating effect of classroom sociable norm in rural areas of China where collectivism may be more encouraged (5). Fourth, we did not explore which factors could mediate the associations between unsociability and internalizing problems while examining the moderating effect of

classroom sociable norm. Possible mediators such as peer relations (3) could be explored in future research.

In spite of the above limitations, there are still some meaningful implications from our study. For the theoretical implications, the findings in the current study demonstrated that classroom sociable norm had an influence on relations between unsociability and internalizing problems for Chinese adolescents. Therefore, the important role of classroom environment, especially for unsociable adolescents was underscored. It is recommended that future researchers explore if other classroom-level variables, such as classroom status hierarchy (34) and classroom aggressive norm (24) could influence unsociable adolescents' adjustment. For the practical implications, the findings from this study could enlighten educators in school that classroom environment is vital for students' development and that sociability is an important characteristic in school life. Therefore, educators could try to establish a benign classroom climate for students, such as telling them to be kind to classmates irrespective of how sociable they are. Moreover, educators should cultivate unsociable adolescents' social competence with some measures, such as teaching them proper social skills and encouraging them to have interactions with other students.

Conclusion

This study was aimed at exploring the moderating effect of classroom sociable norm on the relations between unsociability and internalizing problems in Chinese adolescents. Consistent with our hypotheses, unsociability was associated with more internalizing problems, including higher levels of depression and loneliness, as well as lower level of self-esteem in Chinese adolescents. Moreover, these associations were stronger in classrooms with a higher classroom sociable norm, that is, classrooms where sociability was more preferred by students. The results indicated that unsociable adolescents' adjustment would be influenced by the classroom environment in China and it is essential to explore more classroom-level protective or risk factors for them in the future.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Institutional Review Board of East China Normal University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

YH and JL contributed to conception and design of the study. JL organized the database. YH performed the statistical analysis and wrote the first draft of the manuscript. YH, AB, YZ, and JL wrote sections of the manuscript. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

1. Coplan RJ, Armer M. A "multitude" of solitude: a closer look at social withdrawal and nonsocial play in early childhood. *Child Dev Perspect*. (2007) 1:26–32. doi: 10.1111/j.1750-8606.2007.00006.x

2. Coplan RJ, Ooi LL, Baldwin D. Does it matter when we want to be alone? Exploring developmental timing effects in the implications of unsociability. *New Ideas Psychol*. (2019) 53:47–57. doi: 10.1016/j.newideapsych.2018.01.001

3. Bullock A, Xiao B, Xu G, Liu J, Coplan R, Chen X. Unsociability, peer relations, and psychological maladjustment among children: a moderated-mediated model. *Soc Dev*. (2020) 29:1014–30. doi: 10.1111/sode.12444

4. Wang JM, Rubin KH, Laursen B, Booth-LaForce C, Rose-Krasnor L. Preference-for-solitude and adjustment difficulties in early and late adolescence. *J Clin Child Adolesc Phychol*. (2013) 42:834–42. doi: 10.1080/15374416.2013.794700

5. Ding X, Chen X, Fu R, Li D, Liu J. Relations of shyness and unsociability with adjustment in migrant and non-migrant children in urban China. *J Abnorm Child Psychol*. (2020) 48:289–300. doi: 10.1007/s10802-019-00583-w

6. Xiao B, Bullock A, Liu J, Coplan R. Unsociability, peer rejection, and loneliness in Chinese early adolescents: testing a cross-lagged model. *J Early Adolesc*. (2021) 41:865–85. doi: 10.1177/0272431620961457

7. Zhang L, Eggum-Wilkens ND. Correlates of shyness and unsociability during early adolescence in urban and rural China. *J Early Adolesc*. (2018) 38:408–21. doi: 10.1177/0272431616670993

8. Zhang L, Eggum-Wilkens ND. Unsociability in Chinese adolescents: cross-informant agreement and relations with social and school adjustment. *Soc Dev*. (2018) 27:555–70. doi: 10.1111/sode.12284

9. Chen B-B, Santo JB. The relationships between shyness and unsociability and peer difficulties: the moderating role of insecure attachment. *Int J Behav Dev*. (2016) 40:346–58. doi: 10.1177/0165025415587726

10. Zhao S, Liu M, Chen X, Li D, Liu J, Liu S. Unsociability and psychological and school adjustment in Chinese children: the moderating effects of peer group cultural orientations. *J Cross-Cult Psychol*. (2022) 54:283–302. doi: 10.1177/00220221221132810

11. Zhu J, Ooi LL, Wu M, Li Y, Coplan RJ, Cao Y. Exploring the links between unsociability, parenting behaviors, and socio-emotional functioning in young children in suburban China. *Early Educ Dev*. (2021) 32:963–80. doi: 10.1080/10409289.2020.1821538

12. Bronfenbrenner U. *The ecology of human development: experiments by nature and design*. Cambrige MA: Harvard University Press (1979).

13. Asendorpf JB. Beyond social withdrawal: shyness, unsociability, and peer avoidance. *Hum Dev*. (1990) 33:250–9. doi: 10.1159/000276522

14. Burger JM. Individual differences in preference for solitude. *J Res Pers*. (1995) 29:85–108. doi: 10.1006/jrpe.1995.1005

15. Coplan RJ, Prakash K, O'Neil K, Armer M. Do you "want" to play? Distinguishing between conflicted shyness and social disinterest in early childhood. *Dev Psychol*. (2004) 40:244–58. doi: 10.1037/0012-1649.40.2.244

16. Goossens L. Affinity for aloneness in adolescence and preference for solitude in childhood: linking two research traditions In: RJ Coplan and JC Bowker, editors. *The handbook of solitude: Psychological perspectives on social isolation, social withdrawal, and being alone*. Malden, MA: Wiley Blackwell (2014). 150–66.

17. Bowker JC, Sette S, Ooi LL, Bayram-Ozdemir S, Braathu N, Bølstad E, et al. Cross-cultural measurement of social withdrawal motivations across 10 countries using multiple-group factor analysis alignment. *Int J Behav Dev*. (2023) 47:190–8. doi: 10.1177/01650254221132774

18. Chen X. Shyness-inhibition in childhood and adolescence: a cross-cultural perspective In: KH Rubin and RJ Coplan, editors. *The development of shyness and social withdrawal*. New York, NY: Guilford Press (2010). 213–35.

19. Chen X, French DC. Children's social competence in cultural context. *Annu Rev Psychol*. (2008) 59:591–616. doi: 10.1146/annurev.psych.59.103006.093606

20. Liu J, Chen X, Coplan RJ, Ding X, Zarbatany L, Ellis W. Shyness and unsociability and their relations with adjustment in Chinese and Canadian children. *J Cross-Cult Psychol*. (2015) 46:371–86. doi: 10.1177/0022022114567537

21. Coplan RJ, Liu J, Ooi LL, Chen X, Li D, Ding X. A person-oriented analysis of social withdrawal in Chinese children. *Soc Dev*. (2016) 25:794–811. doi: 10.1111/sode.12181

22. Cialdini RB, Kallgren CA, Reno RR. A focus theory of normative conduct: a theoretical refinement and reevaluation of the role of norms in human behavior. *Adv Exp Soc Psychol*. (1991) 24:201–34. doi: 10.1016/S0065-2601(08)60330-5

23. Henry D, Guerra N, Huesmann R, Tolan P, VanAcker R, Eron L. Normative influences on aggression in urban elementary school classrooms. *Am J Community Psychol*. (2000) 28:59–81. doi: 10.1023/A:1005142429725

24. Laninga-Wijnen L, Harakeh Z, Steglich C, Dijkstra JK, Veenstra R, Vollebergh W. The norms of popular peers moderate friendship dynamics of adolescent aggression. *Child Dev*. (2017) 88:1265–83. doi: 10.1111/cdev.12650

25. Garandeau CF, Vermande MM, Reijntjes AHA, Aarts E. Classroom bullying norms and peer status: effects on victim-oriented and bully-oriented defending. *Int J Behav Dev*. (2022) 46:401–10. doi: 10.1177/0165025419894722

26. Laninga-Wijnen L, van den Berg YHM, Mainhard T, Cillessen AHN. The role of defending norms in victims' classroom climate perceptions and psychosocial maladjustment in secondary school. *J Abnorm Child Psychol*. (2021) 49:169–84. doi: 10.1007/s10802-020-00738-0

27. Ding X, Weeks M, Liu J, Sang B, Zhou Y. Relations between unsociability and peer problems in Chinese children: moderating effect of behavioural control. *Infant Child Dev*. (2015) 24:94–103. doi: 10.1002/icd.1864

28. Barstead MG, Smith KA, Laursen B, Booth-LaForce C, King S, Rubin KH. Shyness, preference for solitude, and adolescent internalizing: the roles of maternal, paternal, and best-friend support. *J Res Adolesc*. (2018) 28:488–504. doi: 10.1111/jora.12350

29. Thomas A, Chess S. *Temperament and development*. Levittown, PA: Brunner/Mazel (1977).

30. Boivin M, Dodge KA, Coie JD. Individual-group behavioral similarity and peer status in experimental play groups of boys: the social misfit revisited. *J Pers Soc Psychol*. (1995) 69:269–79. doi: 10.1037/0022-3514.69.2.269

31. Bass EC, Santo JB, da Cunha JM, Neufeld C. Classroom context and the relations between social withdrawal and peer victimization. *J Cogn Educ Psychol*. (2016) 15:248–67. doi: 10.1891/1945-8959.15.2.248

32. Guimond F-A, Brendgen M, Correia S, Turgeon L, Vitaro F. The moderating role of peer norms in the associations of social withdrawal and aggression with peer victimization. *Dev Psychol*. (2018) 54:1519–27. doi: 10.1037/dev0000539

33. Hartup WW. The company they keep: friendships and their developmental significance. *Child Dev*. (1996) 67:1–13. doi: 10.2307/1131681

34. Garandeau CF, Lee IA, Salmivalli C. Inequality matters: classroom status hierarchy and adolescents' bullying. *J Youth Adolesc*. (2014) 43:1123–33. doi: 10.1007/s10964-013-0040-4

35. Hawley PH. Prosocial and coercive configurations of resource control in early adolescence: a case for the well-adapted machiavellian. *Merrill Palmer Q*. (2003) 49:279–309. doi: 10.1353/mpq.2003.0013

36. Shin H. Examining early adolescents' peer climate using descriptive and status norms on academic engagement and aggressive behavior in the classroom. *Asia Pac Educ Rev*. (2017) 18:309–20. doi: 10.1007/s12564-017-9494-5

37. Laninga-Wijnen L, Harakeh Z, Dijkstra JK, Veenstra R, Vollebergh W. Aggressive and prosocial peer norms: change, stability, and associations with adolescent aggressive and prosocial behavior development. *J Early Adolesc*. (2018) 38:178–203. doi: 10.1177/0272431616665211

38. Lam CB, McHale SM, Crouter AC. Time with peers from middle childhood to late adolescence: developmental course and adjustment correlates. *Child Dev*. (2014) 85:1677–93. doi: 10.1111/cdev.12235

39. Festinger L. A theory of social comparison processes. *Hum Relat*. (1954) 7:117–40. doi: 10.1177/001872675400700202

40. Wright JC, Giammarino M, Parad HW. Social status in small groups: individual-group similarity and the social "misfit". *J Pers Soc Psychol*. (1986) 50:523–36. doi: 10.1037/0022-3514.50.3.523

41. Liu J, Bowker JC, Coplan RJ, Yang P, Li D, Chen X. Evaluating links among shyness, peer relations, and internalizing problems in Chinese young adolescents. *J Res Adolesc*. (2019) 29:696–709. doi: 10.1111/jora.12406

42. van den Berg YHM, Lansu TAM, Cillessen AHN. Preference and popularity as distinct forms of status: a meta-analytic review of 20 years of research. *J Adolesc*. (2020) 84:78–95. doi: 10.1016/j.adolescence.2020.07.010

43. Schwartz D, Tom SR, Chang L, Xu Y, Duong MT, Kelly BM. Popularity and acceptance as distinct dimensions of social standing for Chinese children in Hong Kong. *Soc Dev*. (2010) 19:681–97. doi: 10.1111/j.1467-9507.2009.00558.x

44. Liu J, Coplan RJ, Chen X, Li D, Ding X, Zhou Y. Unsociability and shyness in Chinese children: concurrent and predictive relations with indices of adjustment. *Soc Dev*. (2014) 23:119–36. doi: 10.1111/sode.12034

45. Saarento S, Garandeau CF, Salmivalli C. Classroom- and school-level contributions to bullying and victimization: a review. *J Community Appl Soc Psychol*. (2015) 25:204–18. doi: 10.1002/casp.2207

46. China Statistical Yearbook. National Bureau of statistics of China In: . *China statistical yearbook*. Beijing: Peking Union Medical College Press (2012)

47. Chen X. Social reputation and peer relationships in Chinese and Canadian children: a cross-cultural study. *Child Dev*. (1992) 63:1336–43. doi: 10.2307/1131559

48. Masten AS, Morison P, Pellegrini DS. A revised class play method of peer assessment. *Dev Psychol*. (1985) 21:523–33. doi: 10.1037/0012-1649.21.3.523

49. Terry R, Coie JD. A comparison of methods for defining sociometric status among children. *Dev Psychol*. (1991) 27:867–80. doi: 10.1037/0012-1649.27.5.867

50. Coie JD, Dodge KA, Coppotelli H. Dimensions and types of social status: a cross-age perspective. *Dev Psychol*. (1982) 18:557–70. doi: 10.1037/0012-1649.18.4.557

51. Chen X, Rubin KH, Li Z-y. Social functioning and adjustment in Chinese children: a longitudinal study. *Dev Psychol*. (1995) 31:531–9. doi: 10.1037/0012-1649.31.4.531

52. Kovacs M. The Children's depression inventory (CDI). *Psychopharmacol Bull*. (1985) 21:995–8.

53. Chen X, Cen G, Li D, He Y. Social functioning and adjustment in Chinese children: the imprint of historical time. *Child Dev*. (2005) 76:182–95. doi: 10.1111/j.1467-8624.2005.00838.x

54. Asher SR, Hymel S, Renshaw PD. Loneliness in children. *Child Dev*. (1984) 55:1456–64. doi: 10.2307/1130015

55. Harter S. *Self-perception profile for children (manual)*. Denvor, CO: University of Denver (1985).

56. Chen X, Rubin KH, Li B-s, Li D. Adolescent outcomes of social functioning in Chinese children. *Int J Behav Dev*. (1999) 23:199–223. doi: 10.1080/016502599384071

57. Muthén LK, Muthén BO. *Mplus statistical modeling software: Release 7.0*. Los Angeles, CA: Muthén and Muthén (2012).

58. Aiken LS, West SG. *Multiple regression: Testing and interpreting interactions*. Newbury Park; Thousand Oaks, CA: Sage Publications, Inc (1991).

59. Graham JW. Missing data analysis: making it work in the real world. *Annu Rev Psychol*. (2009) 60:549–76. doi: 10.1146/annurev.psych.58.110405.085530

60. Little RJA. A test of missing completely at random for multivariate data with missing values. *J Am Stat Assoc*. (1988) 83:1198–202. doi: 10.1080/01621459.1988.10478722

61. Ullman J. Structural equation modeling In: B Tabachnick and L Fidell, editors. *Using multivariate statistics*. Boston, MA: Allyn and Bacon (2013). 681–785.

62. Peugh JL. A practical guide to multilevel modeling. *J Sch Psychol*. (2010) 48:85–112. doi: 10.1016/j.jsp.2009.09.002

63. Coplan RJ, Rose-Krasnor L, Weeks M, Kingsbury A, Kingsbury M, Bullock A. Alone is a crowd: social motivations, social withdrawal, and socioemotional functioning in later childhood. *Dev Psychol*. (2013) 49:861–75. doi: 10.1037/a0028861

64. Brewer MB. The social self: on being the same and different at the same time. *Personal Soc Psychol Bull*. (1991) 17:475–82. doi: 10.1177/0146167291175001

65. Schutz WC. *The interpersonal underworld*. Palo Alto, CA: Science and Behavior Books (1966).

frontiers | Frontiers in Psychiatry

TYPE Original Research
PUBLISHED 06 July 2023
DOI 10.3389/fpsyt.2023.1151534

OPEN ACCESS

EDITED BY
Gerard Leavey,
Ulster University, United Kingdom

REVIEWED BY
Yu Xiong,
University of Illinois at Urbana-Champaign, United States
António José Santos,
University Institute of Psychological, Social and Life Sciences (ISPA), Portugal

*CORRESPONDENCE
Junsheng Liu
✉ jsliu@psy.ecnu.edu.cn

RECEIVED 26 January 2023
ACCEPTED 19 June 2023
PUBLISHED 06 July 2023

CITATION
Chen X, Sun X, Wu X, Liu J, Li D and Chen X (2023) Growth of preference for solitude in urban and rural Chinese adolescents.
Front. Psychiatry 14:1151534.
doi: 10.3389/fpsyt.2023.1151534

Growth of preference for solitude in urban and rural Chinese adolescents

Xi Chen[1,2], Xinxin Sun[1], Xuan Wu[1], Junsheng Liu[1,3]*, Dan Li[4] and Xinyin Chen[5]

[1]School of Psychology and Cognitive Science, East China Normal University, Shanghai, China, [2]Shanghai Key Laboratory of Mental Health and Psychological Crisis Intervention, Shanghai, China, [3]Shanghai Changning Mental Health Center, Shanghai, China, [4]Department of Psychology, Shanghai Normal University, Shanghai, China, [5]Graduate School of Education, University of Pennsylvania, Philadelphia, PA, United States

Introduction: As individuals enter adolescence, their preference for solitude (PFS) increases with age, which may be a result of balancing the need for social affiliation and the need for autonomy and independence. These needs are shaped by the social-cultural contexts, and thus the growth rate of PFS may differ across social-cultural contexts.This study examined to what extent the developmental trajectory of PFS differed between urban and rural Chinese adolescents.

Methods: Adolescents in urban (n = 326,168 boys, Mage =12.00 years, SD = 0.61) and rural (n = 449, 198 boys, Mage =11.82 years, SD = 0.58) regions in China reported their PFS and shyness each year from Grade 6 to Grade 8. Longitudinal measurement invariance of PFS was established between the urban and rural samples. Location and gender differences in the intercept and the slope of PFS were examined using a latent growth model, while controlling for shyness at each time point.

Results: The analyses revealed that adolescents in both urban and rural regions showed an increasing trajectory of PFS. Although urban and rural adolescents did not differ in the initial level of PFS at Grade 6, urban adolescents' PFS increased faster than that of the rural adolescents. The urban-rural difference in the slope of PFS remained significant after controlling for the associations between the intercept and the slope of PFS and shyness at each time point. In addition, in the rural region, boys showed a faster increase of PFS than girls, yet gender differences in the initial level of PFS and the developmental trajectory in the urban region were nonsignificant.

Discussion: The findings reveal a normative increasing trend of PFS during early adolescence and faster increase for urban than rural adolescents. To promote adolescents' psychological well-being, parents, teachers and practitioners need to help adolescents establish a good balance between social interaction and solitude. When deciding what is a good balance, it is important to consider the social-cultural context.

KEYWORDS

preference for solitude, adolescents, social-cultural context, urban, rural, China

Introduction

Preference for solitude (PFS) refers to individuals' tendency to engage in and enjoy solitary activities over being with others (1, 2). Individuals with high PFS have relatively low social approach motivation but do not necessarily feel lonely when alone or anxious in social interaction. As individuals enter adolescence, their PFS increases with age (3–5). There have

been arguments regarding the implications of PFS for adolescents. While higher levels and faster increase of PFS was found to be associated with negative peer experience and adjustment outcomes, such as peer victimization, depression, emotion dysregulation, and lower self-esteem (5–7), a few recent studies revealed positive implications of PFS, especially when it is driven by intrinsic enjoyment of solitary activities (4, 8). Thus, understanding factors that contribute to the normative growth of PFS during adolescence helps us interpret its meaning and decide whether or under what conditions we need to be concerned with such growth.

Adolescents may seek more solitude due to various reasons (5, 8), and one of these reasons may be their increasing need for autonomy and independence (9–12). The normative growth of PFS during adolescence may be a result of balancing the need for social affiliation and the need for autonomy and independence. If so, given that these needs may be shaped by the social-cultural contexts (13–15), one would expect differences in the growth rate of PFS across different social-cultural contexts. Examining this social-cultural difference can help us better understand the phenomena of increasing PFS during adolescence.

China has traditionally been a group-oriented society, where individual autonomy is less emphasized than interdependent social relationships. PFS was found to be associated with more adjustment difficulties for Chinese than Western adolescents (16). In the past several decades, with the development of the market economy and the introduction of Western values, individual autonomy is increasingly endorsed by Chinese parents and children (17), and this change happens faster in urban than in rural regions (18, 19). Thus, urban adolescents' need for autonomy and independence may increase faster than that of rural adolescents. In the current study, we examined whether urban adolescents showed more rapid growth of PFS than rural adolescents in China.

Developmental trajectory of PFS in adolescence

Adolescence is a unique developmental period to study PFS. On the one hand, individuals spend more and more time with peers from middle childhood to late adolescence (20). On the other hand, as individuals enter adolescence, they may have increasing need for personal space and may voluntarily use their time in solitude for creative activities, emotional regulation and identity development (10–12). Establishing a balance between the need for social affiliation and the increasing need for independence and autonomy is an important developmental task for adolescents (21, 22). The normative growth of PFS may reflect how such a balance change during adolescence.

Age differences in PFS have been examined primarily in Western countries in cross-sectional studies. These studies have shown that adolescents spent more time in solitude than preadolescents (23) and older adolescents had a more positive attitude toward solitude than younger adolescents (11, 24, 25). Fewer studies have examined the developmental trajectory of PFS longitudinally. For example, a study following a U.S. sample from kindergarten to Grade 12 found an increasing trajectory of PFS, especially after children enter Grade 6 (5). Another study following a Flemish sample from 15 to 18 years of age also found an increasing trajectory of positive attitude toward solitude (3). Less is known about the development of PFS in non-Western countries, such as China. A recent study found that Chinese adolescents reported increasing enjoyment in solitude from Grade 7 to Grade 9 (4). Taken together, these studies suggest a normative increase of PFS during adolescence. To what extent the increasing rate of PFS differ across social-cultural contexts remains to be examined.

The role of social-cultural contexts in the development of PFS

Adolescents' increasing need for independence and autonomy may be more salient in self-oriented contexts than in group-oriented contexts (26). In more self-oriented contexts, such as in Western countries and urban regions in China, individuals are more likely to experience themselves as independent and distinct from others, whereas in more group-oriented contexts, such as rural regions in China, individuals are more likely to experience themselves as enmeshed in families, communities and work groups (13–15). Thus, in more self-oriented contexts, as individuals enter adolescence, they may be driven by a stronger desire to gain autonomy and establish unique identity. This is supported by previous studies showing that U.S. adolescents showed a faster increase in decision-making autonomy than did Chinese adolescents from Grade 7 to Grade 8 (26) and that urban Chinese third-to-sixth graders were reported by their peers as more assertive than their rural counterparts (18). Align with these findings, adolescents in more self-oriented social-cultural contexts may also show faster increase of PFS.

In addition, meanings of PFS may differ between self-oriented and group-oriented contexts. In more self-oriented contexts, PFS may be viewed as a personal choice and an indicator of self-sufficiency (2). In more group-oriented contexts, individuals are expected to inhibit the expression of their own needs, attend to others' needs and contribute to the collective welfare (13–15), so PFS may be viewed as more problematic and elicit negative reactions from peers, teachers and parents (16, 27). Given that social evaluations and responses serve as important feedback to shape individuals' developmental patterns (28), negative social reactions to PFS in more group-oriented contexts may restrain the normative growth of PFS during adolescence.

Only a handful of empirical studies have examined the associations between social-cultural contexts and the development of PFS. A cross-cultural study found that higher PFS was associated with lower peer preference, academic achievement, self-worth and higher loneliness more strongly among Chinese fourth to eighth graders than their Canadian counterparts (16). A more recent study examined PFS among non-migrant and migrant fourth to seventh graders in a Chinese urban region (27). Migrant children moved from rural regions to the urban region and were supposed to hold more group-oriented values than non-migrant urban children. Although the mean levels of PFS did not significantly differ between non-migrant and migrant adolescents, higher PFS was associated with lower peer preference and leadership status more strongly among migrant than non-migrant adolescents. These two studies show that PFS is associated with adjustment difficulties more strongly in more group-oriented contexts. The more negative meanings of PFS in group-oriented contexts may restrain the normative increase of PFS during adolescence in those contexts.

Another line of research has revealed that people in more group-oriented cultures reported higher levels of loneliness than those in the more self-oriented cultures (29, 30). According to the

culture-loneliness framework (31), although people in more-group oriented cultures are less likely to be physically isolated compared with those in more self-oriented cultures, they may be more likely to perceive isolation. Because interdependent relationships and conformity to groups are more emphasized in group-oriented cultures, people in these cultures may internalize higher standards regarding ideal social connections, perceive greater discrepancies between ideal and actual social connections, and thus experience higher loneliness. In addition, according to the evolutionary theory of loneliness (32, 33), loneliness may serve as a warning signal and motivates people to repair their insufficient social connections. Thus, experience of higher levels of loneliness may motivate people in group-oriented cultures to seek for more social connections rather than isolation. Adolescents in more group-oriented contexts may also experience more loneliness than those in more self-oriented contexts, and thus may show slower increase in their PFS. Yet, to our knowledge, there has not been any study examining to what extent the developmental trajectory of PFS differs depending on social-cultural contexts.

The current study

The core aim of this study is to investigate to what extent the developmental trajectory of PFS during adolescence differ across social-cultural contexts. With social changes in China, families and children adopt increasingly self-oriented values, and these changes happen faster in urban regions than in rural regions (18, 19). Thus, we compared the developmental trajectory of PFS among Chinese adolescents in urban and rural regions. Sixth graders were followed for 3 years and reported their PFS each year to obtain their developmental trajectory of PFS. We decided to examine the developmental trajectory starting from Grade 6 because this is the period when PFS began to show faster growth in previous studies (5, 11, 23). We hypothesized that urban adolescents would show higher initial levels and faster growth of PFS than rural adolescents. In addition, given mixed findings regarding gender difference in the development of PFS [see higher PFS in boys than girls in (5, 16), higher enjoyment of solitude in girls than boys in (4), and nonsignificant gender difference in (27)], we also explored gender difference and the interaction between gender and location (urban vs. rural) without specific hypotheses.

In addition, we conducted follow-up analyses to examine whether the urban-rural differences in the development of PFS remained significant after controlling for shyness at each time point, because shyness is closely related to PFS and its prevalence and meaning also differ across social-cultural contexts. Specifically, shyness is a dimension of social withdrawal driven by different motivations compared with PFS (34). Shy children have relatively high social approach motivation, but feel anxious when interacting with others, especially with unfamiliar people (35). Shyness may be more accepted in group-oriented contexts than in self-oriented contexts. Compared with their urban counterparts, rural or migrant children and adolescents in China show higher levels of shyness, and for them shyness is associated with negative developmental outcomes to a less extent (27, 36). After controlling for shyness, PFS more purely reflects low social approach motivation, and we would be able to examine social-cultural differences in adolescents' development of PFS more rigorously.

Method

Participants

Data used in this study originate from two comprehensive longitudinal studies of the psychological and social adjustment of adolescents in mainland China [(blinded for review)]. Participants in the urban group were 326 adolescents (168 boys, $M_{age} = 12.00$ years, SD = 0.61) from Shanghai, an international megacity in East China with top economic strength. Participants in the rural group were 449 adolescents (198 boys, $M_{age} = 11.82$ years, SD = 0.58) with rural registration status in Xuancheng, Anhui province. Xuancheng is a prefecture-level city in East China with moderate economic strength and about 40% of the population reside in rural regions. The participants were recruited from regular public schools randomly selected in the two regions. The regular public schools serve students within the surrounding residential areas rather than select students based on their academic performance or special talent.

At the first time point (Time 1), the adolescents were at Grade 6. Among the adolescents, 59.8 and 45.0% from the urban and rural groups, respectively, were only children, while the rest had one or more siblings. The majority of the adolescents, 78.8 and 73.3% in the urban and rural groups, respectively, were living with both parents, 5.8 and 3.1% living with one parent and others (e.g., step parent), 5.5 and 12.0% living with one parent, 1.8 and 10.5% living with someone other than a parent, and 8.0 and 1.1% did not report this information. Among the parents, 67.8% of the fathers and 63.8% of the mothers in the urban group, 63.9% of the fathers and 48.8% of the mothers in the rural group, had completed junior middle school or higher levels of education.

Procedure

Data were collected in May and June of each year from 2013 to 2015 in Shanghai, and from 2012 to 2014 in Anhui, respectively. At each time point (Time 1 = Grade 6, Time 2 = Grade 7, Time 3 = Grade 8), participants completed questionnaires regarding their PFS, shyness and demographic information. Participants completed the questionnaires in a group setting at school led by a team of undergraduate and graduate students majored in psychology. Prior to data collection, approvals from the schools and written informed consent from the parents were obtained.

Measures

Preference for solitude

PFS was assessed using the Chinese version of the Child Social Preference Questionnaire [CSPQ, (34)]. We focused on the unsociable subscale, which included seven statements pertaining to preference for spending time alone (e.g., "if given a choice, I prefer to play alone than with other kids," "I usually prefer doing things alone") rated on a 5-point scale (1 = never; 5 = always). Good psychometric properties and construct validity of CSPQ has been demonstrated in samples of Chinese children and adolescents (34). Internal reliability of this questionnaire in the current study was acceptable, as indicated by *Cronbach's* α ranging from 0.876 to 0.925 in the urban group and from 0.856 to 0.902 in the rural group across the time points.

TABLE 1 Means and standard deviations of preference for solitude.

	Urban			Rural		
	Average	Boys	Girls	Average	Boys	Girls
PFS Time 1	2.21 (1.00)	2.19 (1.11)	2.23 (0.89)	2.29 (0.90)	2.20 (0.95)	2.35 (0.86)
PFS Time 2	2.36 (1.03)	2.33 (1.06)	2.40 (1.00)	2.30 (0.91)	2.30 (0.95)	2.30 (0.88)
PFS Time 3	2.49 (1.01)	2.50 (1.10)	2.49 (0.93)	2.38 (0.89)	2.42 (0.96)	2.36 (0.85)

PFS, Preference of Solitude.

Shyness

Shyness was assessed using a modified Chinese version of the Children's shyness Questionnaire (CSQ, (37), (38)), which includes 12 statements pertaining shyness (e.g., "I feel shy when I have to read aloud in front of the whole class") rated on a 3-point scale (1 = No; 3 = Yes). The measure was found to be reliable and had good construct validity in the Chinese context (34). Internal reliability of this questionnaire in the current study was acceptable, as indicated by *Cronbach's* α ranging from 0.834 to 0.865 in the urban group and from 0.771 to 0.844 in the rural group across the time points.

Statistical analysis plan

Analyses were carried out in three steps. First, descriptive statistics, correlations of PFS across all time points in urban and rural groups and patterns of missing data were examined. Second, measurement invariance of PFS across time points and between the two groups was evaluated by fitting and comparing a series of sequentially more constrained models. Finally, three latent growth models were fitted to address the main research questions. Two separate models for the urban and rural groups were first fitted to examine the developmental trajectory of PFS and gender as a predictor of the intercept and slope of PFS. Then a main model was fitted to examine location (i.e., urban vs. rural), gender and the interaction between location and gender as predictors of the intercept and slope of PFS. In the follow-up analyses, we first examined measurement invariance of shyness across time points and between the two groups. Then, we fitted the main model when controlling for the association between PFS and shyness and the effect of location and gender on shyness. The Chi-square test, comparative fit index (CFI), Tucker-Lewis index (TLI), and root-mean-square error of approximation (RMSEA) were employed to assess model fit. To be considered acceptable, model fit had to meet the criteria of CFI ≥ 0.90, TLI ≥ 0.90, and RMSEA ≤0.08 (39).

Results

Preliminary analyses

Descriptive statistics of PFS for boys and girls in the urban and rural groups at each time point are presented in Table 1. Independent *t*-tests showed that PFS did not significantly differ between the urban and rural groups or between boys and girls in each group at each time point. Bivariate correlations between PFS in the urban and rural groups at each time point are presented in Table 2.

The percentage of missing data were 8.7 and 35.8% at Time 2, 28.4 and 39.4% at Time 3 for the urban and rural groups, respectively. The Little's missing completely at random (MCAR) test (40) indicated that data were MCAR, $\chi^2(9) = 9.032$, $p = 0.434$. Independent sample *t*-tests showed no significant difference in PFS at Time 1 between children who participated at both Time 1 and Time 2 ($M = 2.22$, SD = 0.94) and those who were missing at Time 2 ($M = 2.34$, SD = 0.96), $t(744) = 1.622$, $p = 0.105$. Similarly, no significant difference was found in PFS at Time 2 between children who participated at both Time 2 and Time 3 ($M = 2.32$, SD = 0.95) and those who were missing at Time 3 ($M = 2.39$, SD = 1.04), $t(558) = 0.575$, $p = 0.565$. We also conducted these analyses separately for the urban and rural groups, and the results were consistent between the two groups. We handled missing data using the full information maximum likelihood (FIML) estimation.

TABLE 2 Bivariate correlations between preference for solitude at different time points.

	1	2	3
1. PFS Time1	–	0.476***	0.392***
2. PFS Time2	0.531***	–	0.586***
3. PFS Time3	0.485***	0.612***	–

PFS, Preference of Solitude. Correlations for the urban and rural groups are above and below the diagonal, respectively. ***$p < 0.001$.

Measurement invariance for PFS

As presented in Table 3, scalar measurement invariance of PFS across time points between the urban and rural groups was established, after allowing residuals of two items to covary ("I enjoy being by myself" and "I like spending time alone in my room").

Main models

Results of latent growth models are presented in Table 4. The model for the urban group revealed an increasing slope of PFS from Grade 6 to Grade 8, and the intercept and slope of PFS did not differ between boys and girls. The model for the rural group also revealed an increasing slope of PFS, and boys showed faster growth of PFS than girls, although boys and girls did not differ in their initial levels of PFS at Grade 6. The main model revealed that adolescents in the urban group showed faster growth of PFS than adolescents in the rural group, whereas the intercept of PFS did not significantly differ between the two groups. Gender and the interaction between gender and location did not significantly predict the intercept or slope of PFS.

Follow-up analyses

Longitudinal measurement invariance of shyness cannot be established given the poorly fitted models assuming configural measurement invariance at the three time points for both the urban

TABLE 3 Tests of longitudinal measurement invariance between the urban and rural groups for preference of solitude.

Model	χ^2	df	RMSEA	CFI	TLI	χ^2	$\Delta\chi^2$	Δdf	*p*
Model fit before allowing residuals of items to covary									
M1	887.865	372	0.060	0.904	0.891	–	–	–	–
M2	915.866	390	0.059	0.902	0.894	M2 vs. M1	26.377	18	0.091
M3	950.390	411	0.058	0.899	0.897	M3 vs. M2	31.890	21	0.061
Model fit after allowing residuals of two items to covary[a]									
M1	741.279	366	0.051	0.930	0.919				
M2	767.888	384	0.051	0.928	0.921	M2 vs. M1	25.138	18	0.121
M3	803.364	405	0.050	0.926	0.923	M3 vs. M2	34.331	21	0.033

M1, Configural invariance; M2, Metric invariance; M3, Scalar invariance.[a]Residuals of the two items "I enjoy being by myself" and "I like spending time alone in my room" were allowed to covary according to model modification index.

TABLE 4 Latent growth models for preference for solitude.

	Unstandardized results			Standardized results		
	Estimate	SE	*p*	Estimate	SE	*p*
Model for the urban group (*n* = 326)						
Intercept (I)	2.18 (0.475)	0.09	<0.001	2.86	0.29	<0.001
Slope (S)	0.16 (0.071)	0.05	0.004	0.42	0.15	0.006
I-S covariance	−0.08	0.07	0.242	−0.28	0.17	0.099
Gender→ I	0.06	0.11	0.587	0.04	0.07	0.589
Gender→ S	−0.00	0.07	0.974	−0.00	0.10	0.974
Model fit: χ^2 (2) = 0.218, *p* = 0.897, CFI = 1.000, TLI = 1.022, RMSEA = 0.000						
Model for the rural group (*n* = 449)						
Intercept (I)	2.21 (0.581)	0.07	<0.001	3.18	0.29	<0.001
Slope (S)	0.12 (0.140)	0.05	0.007	0.44	0.21	0.031
I-S covariance	−0.04	0.05	0.362	−0.23	0.18	0.206
Gender→ I	0.14	0.09	0.109	0.10	0.06	0.108
Gender→ S	−0.11	0.05	0.044	−0.20	0.11	0.070
Model fit: χ^2 (2) = 0.486, *p* = 0.784; CFI = 1.000, TLI = 1.022, RMSEA = 0.000						
Model examining location as a predictor of the growth curve (*N* = 775)						
Intercept (I)	2.19 (0.518)	0.05	<0.001	3.04	0.21	<0.001
Slope (S)	0.14 (0.102)	0.04	<0.001	0.43	0.12	<0.001
I-S covariance	−0.06	0.04	0.148	−0.25	0.12	0.046
Location → I	−0.05	0.04	0.270	−0.07	0.06	0.268
Location → S	0.07	0.03	0.010	0.22	0.09	0.013
Gender→ I	0.10	0.07	0.156	0.07	0.05	0.158
Gender→ S	−0.06	0.05	0.207	−0.09	0.07	0.208
Location × Gender→ I	−0.04	0.07	0.598	−0.04	0.07	0.598
Location × Gender→ S	0.05	0.05	0.242	0.11	0.10	0.256
Model fit: χ^2 (4) = 0.683, *p* = 0.953; CFI = 1.000, TLI = 1.000, RMSEA = 0.000						

Location coded as Urban = 1, Rural = −1. Gender coded as Boy = 0, Girl = 1. Residual variance of the intercepts and slopes are reported in parenthesis. Residual variance of the intercept and slope did not differ between the urban and the rural groups.

and rural groups. Thus, we were not able to estimate the latent growth curve for shyness. Yet, configural, metric and scalar invariance for shyness at each time point between the urban and rural groups were established (see Table 5). Thus, we estimated the covariance between the intercept and the slope of PFS and shyness at each time point, as well as the predictive effects of location and gender on shyness at each time point (see Figure 1). In this follow-up analysis, urban adolescents continued to show faster increase of PFS than rural adolescents, and their PFS at Grade 6 did not differ significantly. In addition, rural adolescents reported higher shyness than urban adolescents at each

TABLE 5 Tests of measurement invariance at each time point between the urban and rural groups for shyness.

Model	χ^2	df	RMSEA	CFI	TLI	χ^2	$\Delta\chi^2$	Δdf	*p*
Model fit at Time 1									
M1	205.589	108	0.049	0.934	0.920	–	–	–	–
M2	214.773	119	0.046	0.935	0.928	M2 vs. M1	7.792	11	0.732
M3	270.741	131	0.053	0.906	0.905	M3 vs. M2	58.599	12	0.000
Model fit at Time 2									
M1	227.802	108	0.063	0.924	0.907	–	–	–	–
M2	237.331	119	0.060	0.924	0.916	M2 vs. M1	7.793	11	0.732
M3	307.145	131	0.069	0.888	0.887	M3 vs. M2	75.171	12	0.000
Model fit at Time 3									
M1	212.884	108	0.063	0.931	0.916	–	–	–	–
M2	229.838	119	0.062	0.927	0.919	M2 vs. M1	16.109	11	0.137
M3	282.450	131	0.069	0.901	0.900	M3 vs. M2	55.555	12	0.000

M1, Configural invariance; M2, Metric invariance; M3, Scalar invariance.

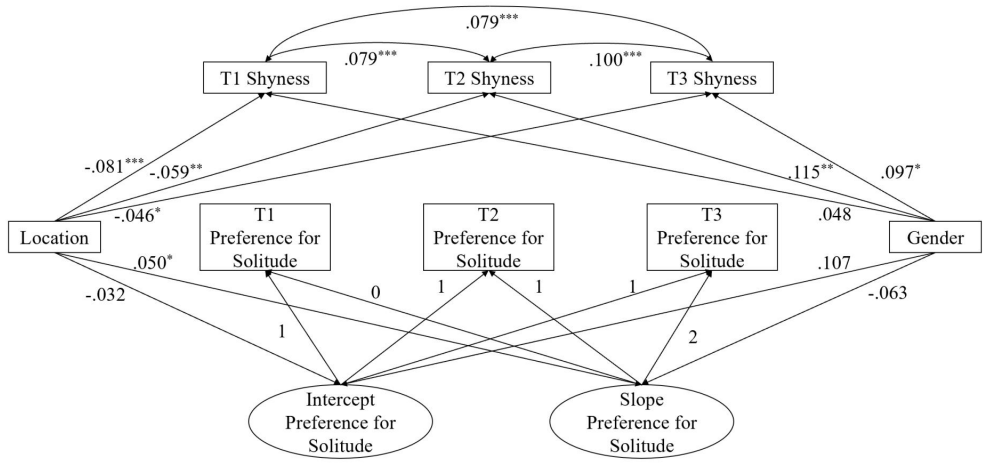


FIGURE 1
Latent growth model of preference for solitude (PFS). *p<0.05, **p<0.01, ***p<0.001. Location coded as Urban=1, Rural=−1. Gender coded as Boy=0, Girl=1. T1=Time 1, T2=Time 2, T3=Time 3. The covariances between the intercept and the clope of PFS and shyness at each time point were estimated but not shown in the figure for ease of presentation. Model fit: χ^2 (6)=1.912 p=0.928; CFI=1.000, TLI=1.000, RMSEA=0.000.

time point, and girls reported higher shyness than boys at Grades 7 and 8. Shyness at each time point was positively related to the intercept of PFS, and higher shyness at Grade 6 was related to slower increase of PFS. Shyness at each time point was positively related with each other.

Discussion

In this study, we compared the developmental trajectory of PFS from Grade 6 to Grade 8 among Chinese adolescents in an urban group and a rural group. Consistent with our hypothesis, both urban and rural adolescents showed an increasing trajectory of PFS from Grade 6 to Grade 8, and the growth rate of PFS among urban adolescents was faster than that of the rural adolescents. We suspect that this difference may be driven by different growth rate of adolescents' need for autonomy and independence in the urban vs. rural regions. As individuals enter adolescence, they may experience a normative increase in their need to gain autonomy and establish a unique identity (21, 22, 26). Driven by this need, adolescents in both urban and rural areas may increasingly seek personal space and appreciate time in solitude. With more rapid social changes happening in urban China, urban adolescents may adopt more self-oriented social values (18, 19), and thus show a faster increase of PFS. In addition, in more group-oriented social contexts, adolescents' PFS may elicit more negative reactions from peers (16, 27), which may further undermine the normative increase of adolescents' PFS in rural regions. Furthermore, in light of the culture-loneliness framework (31) and the evolutionary theory of loneliness (32, 33), we also speculate that rural adolescents may experience higher levels of loneliness, which may serve as an alarming signal for them to maintain social connections and contribute to slower increase of PFS. This finding echoes with existing studies showing social-cultural differences in the implications of PFS (16, 27) and provides additional

evidence regarding the role of social-cultural contexts in the development of adolescents' PFS.

Inconsistent with our hypothesis, the initial level of PFS at Grade 6 did not differ between the urban and rural groups. Since PFS begins to show a faster increase as individuals enter adolescence (5, 11, 23), social-cultural difference in the average levels of PFS may take time to emerge. In fact, the comparison of PFS between the two groups at each time point did not reveal significant difference. Previous studies comparing mean levels of PFS between Chinese and Canadian children and between migrant and non-migrant urban Chinese children (age ranging from Grade 4 to Grade 8) did not find significant difference either. It is possible that the social-cultural effect on the development of PFS first demonstrates in different growth rate. With accumulation, difference in the mean levels of PFS may emerge in later adolescence, which merits investigation in future studies.

As to gender difference, we found that boys showed faster growth than girls in the rural group. This finding aligns more with the existing studies showing higher PFS in boys than in girls. For example, Liu et al. (16) found that boys in fourth to eighth grade were reported by their peers as having higher PFS than girls. Ladd et al. (5) found that although boys and girls showed a similar growth trend of PFS from kindergarten to Grade 12, with the accumulation of gender difference, by late adolescence, boys scored higher than girls on PFS. We suspect that the gender difference may be attributed to gender-stereotypical ideologies that boys should be more independent and autonomous, whereas girls are more expected to develop and maintain close social relationships (41, 42). In contrast with the rural group, the gender difference in the urban group was not significant. This may be due to a relatively more egalitarian gender role in urban areas than in rural areas (43, 44). This social-cultural effect on gender difference needs further examination, given the nonsignificant interaction between location and gender in the trajectory of PFS.

After controlling for the associations between shyness and the development of PFS, the urban-rural difference in the growth rate of PFS remained significant. In addition, consistent with existing findings (27, 38), we found that rural adolescents reported higher shyness than urban adolescents at each time point, and girls reported higher shyness than boys at Grades 7 and 8. Although both PFS and shyness contribute to social withdrawal behaviors, they showed distinct associations with the social-cultural context and gender. This may be due to the different motivations for social connections underlying PFS and shyness. Adolescents with high PFS have low social approach motivation, which is more accepted in self-oriented contexts (34). In contrast, shyness reflects high social approach motivation combined with anxious for social evaluation, which is more accepted in group-oriented contexts (27, 38) and aligns with the gender-stereotypical ideology that girls should value close social relationships (41, 42). These findings show the difference between PFS and shyness and provide additional support for our hypothesis regarding urban-rural difference in the development of PFS.

We note several limitations and future directions. First, we only examined the normative developmental trajectory of PFS, yet there are rich individual differences in this trajectory. A study following children's social withdrawal (a broader concept including both PFS and shyness) from Grade 5 to Grade 8 found three trajectory categories, i.e., a low-stable trajectory, a decreasing trajectory and an increasing trajectory (45). Future studies may examine whether there are sub-groups of adolescents showing qualitatively different developmental trajectories of PFS, and to what extent composition of these sub-groups differ between urban and rural adolescents.

Second, we interpreted the different growth rates of PFS between urban and rural adolescents as due to different cultural values (i.e., self-oriented vs. groups-oriented values) in urban and rural regions, but did not directly analyze adolescents' cultural values as predictors of their developmental trajectory of PFS. An important future direction is to test to what extent difference in the developmental trajectory of PFS across social-cultural contexts can be explained by difference in the mean-level and developmental trajectory of adolescents' cultural values. In addition, future studies may examine whether loneliness acts as a mediator between the social-cultural context and the growth of adolescents' PFS.

Third, related to the previous point, we focused our interpretation on cultural values given existing theoretical (2, 13–15) and empirical (16, 27) work, yet other contextual factors may also contribute to the urban-rural difference in the growth rate of PFS. For example, given that the one-child policy was stricter in urban regions than in rural regions (44), a greater proportion of urban adolescents are only children. Without the company of siblings, only children may have more opportunities to spend time in solitude. To what extent only-children status and other contextual factors, such as having a separate room, may contribute to self-oriented values and the development of PFS needs further investigation.

Fourth, although we inferred the increasing need for independence and autonomy as a factor driving the growth of PFS during adolescence, PFS may be driven by other factors. Solitude may be an active choice due to the intrinsic enjoyment of being alone or a passive reaction to peer rejection or victimization (5, 8). It is an important future direction to explicitly measure the different motivations driving PFS and examine how these motivations jointly contribute to the development of PFS during adolescence.

Finally, the participants were from only two regions and the findings may not be generalizable to other urban and rural regions. The urban participants were from Shanghai, one of the most developed and internationalized cities in China. Adolescents in Shanghai may hold more self-oriented values and show more rapid growth of PFS than adolescents from less developed urban regions. The rural participants were from a region with moderate economic strength in East China and they may show more rapid growth of PFS than adolescents in more remote and less developed rural regions. Thus, findings of the current study need to be replicated in other urban and rural regions in China.

Despite these limitations, this study enriches our understanding about the development of PFS during adolescence by using a longitudinal design and comparing the developmental trajectory across social-cultural contexts. The findings reveal a normative increasing trend of PFS during early adolescence and faster increase for urban than rural adolescents, as well as faster increase for boys than girls in rural regions. The urban-rural difference in the growth of PFS remained significant after controlling for shyness. While excessive PFS may result from negative peer experience and contribute to adjustment difficulties (5, 16, 27), the normative increase of PFS during adolescence may be partially driven by adolescents' growing need for independence and autonomy and have positive

implications for their adjustment (4). In fact, both negative feelings due to not meeting ones' need for social connections [i.e., loneliness; (46)] and negative feelings due to not meeting ones' need for solitude [i.e., aloneliness; (47, 48)] have negative implications for individuals' mental health and adjustment. Thus, to promote adolescents' psychological well-being, parents, teachers and practitioners need to help adolescents establish a good balance between social interaction and solitude. Considering the faster increase of PFS in urban adolescents than in rural adolescents, it is important to consider the social-cultural context when deciding what is a good balance between social interaction and solitude.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by East China Normal University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

XiC contributed idea of the manuscript, conducted the main analyses, wrote the Introduction and Discussion, and revised the Method and Results. XS conducted literature review and supplementary analyses. XW conducted descriptive analyses, wrote an initial draft of the Method and Results, and made the initial versions of the tables. JL, XinC, and DL conducted the larger studies, from which data in this manuscript were drawn. All authors contributed to the article and approved the submitted version.

Funding

This study was supported by the Research Project of Shanghai Science and Technology Commission(20dz2260300), the Fundamental Research Funds for the Central Universities (2020ECNU-HLYT052; 2021ECNU-YYJ019) and the Shanghai Sailing Program (21YF1411300).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

1. Coplan RJ, Rose-Krasnor L, Weeks M, Kingsbury A, Kingsbury M, Bullock A. Alone is a crowd: social motivations, social withdrawal, and socioemotional functioning in later childhood. *Dev Psychol*. (2013) 49:861–75. doi: 10.1037/a0028861

2. Rubin KH, Coplan RJ, Bowker JC. Social withdrawal in childhood. *Annu Rev Psychol*. (2009) 60:141–71. doi: 10.1146/annurev.psych.60.110707.163642

3. Danneel S, Maes M, Vanhalst J, Bijttebier P, Goossens L. Developmental change in loneliness and attitudes toward aloneness in adolescence. *J Youth Adolesc*. (2018) 47:148–61. doi: 10.1007/s10964-017-0685-5

4. Hu N, Xu G, Chen X, Yuan M, Liu J, Coplan RJ, et al. A parallel latent growth model of affinity for solitude and depressive symptoms among Chinese early adolescents. *J Youth Adolesc*. (2022) 51:904–14. doi: 10.1007/s10964-022-01595-4

5. Ladd GW, Ettekal I, Kochenderfer-Ladd B. Longitudinal changes in victimized youth's social anxiety and solitary behavior. *J Abnorm Child Psychol*. (2019) 47:1211–23. doi: 10.1007/s10802-018-0467-x

6. Wang JM. Preference-for-solitude and depressive symptoms in Chinese adolescents. *Personal Individ Differ*. (2016) 100:151–6. doi: 10.1016/j.paid.2015.09.033

7. Wang JM, Rubin KH, Laursen B, Booth-LaForce C, Rose-Krasnor L. Preference-for-solitude and adjustment difficulties in early and late adolescence. *J Clin Child Adolesc Psychol*. (2013) 42:834–42. doi: 10.1080/15374416.2013.794700

8. Borg ME, Willoughby T. Affinity for solitude and motivations for spending time alone among early and mid-adolescents. *J Youth Adolesc*. (2022) 51:156–68. doi: 10.1007/s10964-021-01520-1

9. Coplan RJ, Hipson WE, Bowker JC. Social withdrawal and aloneliness in adolescence: examining the implications of too much and not enough solitude. *J Youth Adolesc*. (2021) 50:1219–33. doi: 10.1007/s10964-020-1365-0

10. Goossens L. Affinity for aloneness in adolescence and preference for solitude in childhood: linking two research traditions In: RJ Coplan and JC Bowker, editors. *The handbook of solitude: Psychological perspectives on social isolation, social withdrawal, and being alone*: Wiley-Blackwell (2014). 150–66.

11. Larson RW. The emergence of solitude as a constructive domain of experience in early adolescence. *Child Dev*. (1997) 68:80–93. doi: 10.2307/1131927

12. Long CR, Averill JR. Solitude: an exploration of benefits of being alone. *J Theory Soc Behav*. Hoboken, NJ, United States (2003) 33:21–44. doi: 10.1111/1468-5914.00204

13. Kağıtçıbaşı C. Autonomy and relatedness in cultural context: implications for self and family. *J Cross-Cult Psychol*. (2005) 36:403–22. doi: 10.1177/0022022105275959

14. Markus HR, Kitayama S. Culture and the self: implications for cognition, emotion, and motivation. *Psychol Rev*. (1991) 98:224–53. doi: 10.1037/0033-295X.98.2.224

15. Rothbaum F, Trommsdorff G. Do roots and wings complement or oppose one another? The socialization of relatedness and autonomy in cultural context In: J Grusec and P Hastings, editors. *Handbook of socialization: Theory and research*: New York, NY, United States Guilford (2007). 461–89.

16. Liu J, Chen X, Coplan RJ, Ding X, Zarbatany L, Ellis W. Shyness and unsociability and their relations with adjustment in Chinese and Canadian children. *J Cross-Cult Psychol*. (2015) 46:371–86. doi: 10.1177/0022022114567537

17. Chen X, Chen X, Zhao S, Way N, Yoshikawa H, Zhang G, et al. Autonomy- and connectedness-oriented behaviors of toddlers and mothers at different historical times in urban China. *Dev Psychol*. (2021) 57:1254–60. doi: 10.1037/dev0001224

18. Chen X, Li D. Parental encouragement of initiative-taking and adjustment in Chinese children from rural, urban, and urbanized families. *J Fam Psychol*. (2012) 26:927–36. doi: 10.1037/a0030708

19. Liu X, Fu R, Li D, Liu J, Chen X. Self-and group-orientations and adjustment in urban and rural Chinese children. *J Cross-Cult Psychol*. (2018) 49:1440–56. doi: 10.1177/0022022118795294

20. Lam CB, McHale SM, Crouter AC. Time with peers from middle childhood to late adolescence: developmental course and adjustment correlates. *Child Dev*. (2014) 85:1677–93. doi: 10.1111/cdev.12235

21. Collins W. A., Steinberg L. (2006). Adolescent development in interpersonal context. In: N. Eisenberg (ed.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development*, 6, pp. 1003–1067. Hoboken, NJ: Wiley.

22. Eccles JS, Midgley C, Wigfield A, Buchanan CM, Reuman D, Flanagan C, et al. Development during adolescence: the impact of stage-environment fit on young adolescents' experiences in schools and in families. *Am Psychol*. (1993) 48:90–101. doi: 10.1037/0003-066X.48.2.90

23. Larson R, Richards MH. Daily companionship in late childhood and early adolescence: changing developmental contexts. *Child Dev*. (1991) 62:284–300. doi: 10.2307/1131003

24. Maes M, Klimstra TA, Van den Noortgate W, Goossens L. Factor structure and measurement invariance of a multidimensional loneliness scale: comparisons across gender and age. *J Child Fam Stud*. (2015) 24:1829–37. doi: 10.1007/s10826-014-9986-4

25. Marcoen A, Goossens L. Loneliness, attitude towards aloneness, and solitude: age differences and developmental significance during adolescence In: S Jackson and H Rodriguez-Tome, editors. *Adolescence and its social worlds*. Hove: Erlbaum (1993). 197–227.

26. Qin L, Pomerantz EM, Wang Q. Are gains in decision-making autonomy during early adolescence beneficial for emotional functioning? The case of the United States and China. *Child Dev*. (2009) 80:1705–21. doi: 10.1111/j.1467-8624.2009.01363.x

27. Ding X, Chen X, Fu R, Li D, Liu J. Relations of shyness and unsociability with adjustment in migrant and non-migrant children in urban China. *J Abnorm Child Psychol*. (2020) 48:289–300. doi: 10.1007/s10802-019-00583-w

28. Chen X, French DC. Children's social competence in cultural context. *Annu Rev Psychol*. (2008) 59:591–616. doi: 10.1146/annurev.psych.59.103006.093606

29. Barreto M, Victor C, Hammond C, Eccles A, Richins MT, Qualter P. Loneliness around the world: age, gender, and cultural differences in loneliness. *Personal Individ Differ*. (2021) 169:110066–6. doi: 10.1016/j.paid.2020.110066

30. Lykes VA, Kemmelmeier M. What predicts loneliness? Cultural difference between individualistic and collectivistic societies in Europe. *J Cross-Cult Psychol*. (2014) 45:468–90. doi: 10.1177/0022022113509881

31. Heu LC, van Zomeren M, Hansen N. Does loneliness thrive in relational freedom or restriction? The culture-loneliness framework. *Rev Gen Psychol*. (2021) 25:60–72. doi: 10.1177/1089268020959033

32. Cacioppo JT, Patrick W. *Loneliness: Human nature and the need for social connection* New York, NY, United States W W Norton & Co. (2008).

33. Cacioppo S., Capitanio J. P., and Cacioppo J. T.. Toward a neurology of loneliness. *PPsychological Bulletin*. (2014) 140:1464–1504. doi: 10.1037/a0037618

34. Spithoven AWM, Cacioppo S, Goossens L, Cacioppo JT. Genetic contributions to loneliness and their relevance to the evolutionary theory of loneliness. *Perspect Psychol Sci*. (2019) 14:376–96. doi: 10.1177/1745691618812684

35. Coplan RJ, Liu J, Ooi LL, Chen X, Li D, Ding X. A person-oriented analysis of social withdrawal in Chinese children. *Soc Dev*. (2016) 25:794–811. doi: 10.1111/sode.12181

36. Crozier W.R.. Shyness and self-esteem in middle childhood. *British Journal of Educational Psychology*. (1995) 65:85–95. doi: 10.1111/j.2044-8279.1995.tb01133.x

37. Ding X., Liu J., Coplan R. J., Chen X., Li D., and Sang B.. Self-reported shyness in chinese children: Validation of the Children's shyness questionnaire and exploration of its links with adjustment and the role of coping. *Personality and Individual Differences*. (2014) 68:183–188. doi: 10.1016/j.paid.2014.04.027

38. Asendorpf JB. Beyond social withdrawal: shyness, unsociability, and peer avoidance. *Hum Dev*. (1990) 33:250–9. doi: 10.1159/000276522

39. Chen X, Wang L, Wang Z. Shyness-sensitivity and social, school, and psychological adjustment in rural migrant and urban children in China. *Child Dev*. (2009) 80:1499–513. doi: 10.1111/j.1467-8624.2009.01347.x

40. Kline RB. *Principles and practice of structural equation modeling* New York, NY, United States: Guilford Press (2015).

41. Schlomer GL, Bauman S, Card NA. Best practices for missing data management in counseling psychology. *J Couns Psychol*. (2010) 57:1–10. doi: 10.1037/a0018082

42. Chen X, He Y. The family in mainland China: structure, organization, and significance for child development In: JL Roopnarine and UP Gielen, editors. *Families in global perspective*. Boston, MA: Allyn & Bacon (2004). 51–62.

43. Maccoby EE. *The two sexes: Growing up apart, coming together*. Cambridge, MA: Harvard University Press (1998).

44. Fong VL. China's one-child policy and the empowerment of urban daughters. *Am Anthropol*. (2002) 104:1098–109. doi: 10.1525/aa.2002.104.4.1098

45. Hu Y. Gender and children's housework time in China: examining behavior modeling in context. *J Marriage Fam*. (2015) 77:1126–43. doi: 10.1111/jomf.12225

46. Oh W, Rubin KH, Bowker JC, Booth-LaForce C, Rose-Krasnor L, Laursen B. Trajectories of social withdrawal from middle childhood to early adolescence. *J Abnorm Child Psychol*. (2008) 36:553–66. doi: 10.1007/s10802-007-9199-z

47. Jeste DV, Lee EE, Cacioppo S. Battling the modern behavioral epidemic of loneliness: suggestions for research and interventions. *JAMA Psychiatry (Chicago, IL)*. (2020) 77:553–4. doi: 10.1001/jamapsychiatry.2020.0027

48. Coplan RJ, Hipson WE, Archbell KA, Ooi LL, Baldwin D, Bowker JC. Seeking more solitude: conceptualization, assessment, and implications of aloneliness. *Personal Individ Differ*. (2019) 148:17–26. doi: 10.1016/j.paid.2019.05.020

49. Yang P, Coplan RJ, Zhang Y, Ding X, Zhu Z. Assessment and implications of aloneliness in Chinese children and early adolescents. *J Appl Dev Psychol*. (2023) 85:101514. doi: 10.1016/j.appdev.2023.101514

frontiers | Frontiers in Psychiatry

TYPE Original Research
PUBLISHED 06 July 2023
DOI 10.3389/fpsyt.2023.1173441

OPEN ACCESS

EDITED BY
Stefania Sette,
Sapienza University of Rome, Italy

REVIEWED BY
Federica Zava,
Roma Tre University, Italy
Pablo Queiroz,
Federal University of Rio Grande do Norte, Brazil

*CORRESPONDENCE
Junsheng Liu
✉ jsliu@psy.ecnu.edu.cn

RECEIVED 24 February 2023
ACCEPTED 06 June 2023
PUBLISHED 06 July 2023

CITATION
Zhou T, Liao L, Nguyen T-VT, Li D and Liu J (2023) Solitude profiles and psychological adjustment in Chinese late adolescence: a person-centered research.
Front. Psychiatry 14:1173441.
doi: 10.3389/fpsyt.2023.1173441

Solitude profiles and psychological adjustment in Chinese late adolescence: a person-centered research

Tong Zhou[1], Longyue Liao[1], Thuy-Vy T. Nguyen[2], Dan Li[3] and Junsheng Liu[1,4]*

[1]School of Psychology and Cognitive Science, East China Normal University, Shanghai, China, [2]Department of Psychology, Durham University, Durham, United Kingdom, [3]Department of Psychology, Shanghai Normal University, Shanghai, China, [4]Shanghai Changning Mental Health Center, Shanghai, China

Objectives: From the perspective of person-centered research, the present study aimed to identify the potential profiles of solitude among late adolescents based on their solitary behavior, motivation, attitude, and time alone. In addition, to echo the paradox of solitude, we further explored the links between solitude profiles and adjustment outcomes.

Methods: The participants of the study were 355 late adolescents (56.34% female, M_{age} = 19.71 years old) at three universities in Shanghai, China. Measures of solitary behavior, autonomous motivation for solitude, attitude toward being alone, and time spent alone were collected using adolescents' self-report assessments. The UCLA Loneliness Scale, the Beck Depression Inventory, and the Basic Psychological Needs Scales were measured as indices of adjustment.

Results: Latent profile analysis revealed four distinct groups: absence of the aloneness group (21.13%), the positive motivational solitude group (29.01%), the negative motivational solitude group (38.03%), and the activity-oriented solitude group (11.83%). Differences emerged among these four groups in terms of loneliness, depressive symptoms, and basic needs satisfaction, with adolescents in the negative motivational solitude group facing the most risk of psychological maladjustment.

Conclusion: Findings revealed the possible heterogeneous nature of solitude among Chinese late adolescents and provided a theoretical basis for further understanding of adolescents' solitary state.

KEYWORDS

solitude, late adolescent, latent profile analysis, person-centered approach, psychological maladjustment

1. Introduction

Solitude is defined as a state in which individuals do not interact with others, either in-person or in virtual environments (1). There has been a long-time debate about the costs and benefits of solitude, and individuals can experience solitude both positively and negatively (2). On the one hand, solitude was found to be associated with negative feelings, such as loneliness and depressive symptoms (1, 3, 4). On the other hand, it was believed that positive experiences with solitude could promote self-discovery, creativity, and self-reflection (1).

As late adolescents are far away from families (e.g., embrace the university), it would be important for them to form peer relationship and romantic relationship during the social transition (5, 6). However, late adolescence is also considered to be an important and unique developmental period for solitude (7). During this period, individuals would engage in solitude for completing the corresponding developmental tasks, such as autonomy from parents and identity formation and self-regulation (8). From early to late adolescence, it has been argued that solitude becomes more adaptive (9) and adolescents are more able to enjoy solitude (8) and have more positive attitudes toward aloneness (10). In addition, Eastern Asian societies may place special importance on solitude as it provides time and space for self-reflection, a practice that originated in Taoist and eremitic traditions (11). As such, some Chinese late adolescents may benefit from their solitude experience.

However, despite such theoretical postulation and research evidence on the benefits of solitude, having too much time alone may yield negative consequences. For instance, it has been found that a preference for solitude was positively associated with depressive symptoms among Chinese college students (M_{age} = 21.43 years) (12). Moreover, one study found among Chinese late adolescents (M_{age} = 19.89 years), preference for solitude was positively associated with mobile phone addiction, and such a relationship was mediated by psychological distress (13). Besides, as compared with the norm, adolescents who consistently withdraw from opportunities for peer interactions (age 18–29 years) reported higher levels of depressive symptoms (14). These findings argue that a solitary behavior may contravene values of interdependence and social harmony in the Chinese context (15).

Such inconsistency between the positive and negative sides of solitude reveals a conflicting picture of the potential significance of solitude during adolescence. One possible explanation for this inconsistency is that previous studies that explored solitude mostly applied a variable-centered approach, which captured only one dimension of solitude (e.g., preference for solitude) and failed to acknowledge other components of solitary experiences (16, 17). Understanding whether a person prefers spending time alone over interacting with other people gives little insight into what goes on during solitary states. In other words, different dimensions of solitude may interrelate with each other and configure within an individual's solitary experience in meaningful ways (i.e., the patterning). For example, the reasons why adolescents choose to spend time alone and their behaviors when alone may contribute to whether adolescents could enjoy being alone or not. Such possible patterns of different solitude dimensions may hold unique implications for individual development that cannot be accounted for by any single dimension of solitude. Using a person-centered approach, researchers can reveal the potential heterogeneity of solitude that might exist within the focal population (i.e., late adolescence in the current study) (18) and therefore obtain a better nuanced understanding of solitude. As such, we argued that a person-centered approach should be applied to provide further insights into whether there are distinct groups of adolescents who would perform certain activities and associate with different psychological outcomes while alone.

In line with the potential heterogeneity of solitude, previous researchers argued that solitude is a "complex and multifaceted" concept that includes emotion, cognitive, and behavioral dimensions (19–22). For instance, Larson (8) suggested that, when people spend time alone, they could experience both internal psychological processes, such as emotions and cognitions, and external activities. Long et al. (21) argued that "feelings, activities, and/or outcomes" constituted one's experience of solitude. To elaborate on such multifaceted nature of solitude, the current study would describe solitude from the perspective of motivation (23, 24), attitude (10, 16), behavior (25), and time duration (26).

Motivation for solitude has been studied from the perspective that builds on the self-determination theory (SDT) (27, 28). From this perspective, Thomas and Azmitia (28) categorize motivation for solitude into two types: not self-determined solitude and self-determined solitude. Not self-determined solitude represents reasons for being alone that are rooted in discomfort and negative feelings toward being with other people. However, self-determined solitude represents reasons for being alone that are driven by desires to connect with oneself and to seek privacy, calmness, and freedom. Similarly, building on self-determination theory, Nguyen et al. (24) also suggested that some solitude could be driven by intrinsic (i.e., generally enjoy solitude) and personally meaningful (i.e., value alone time for its benefits) reasons, while others might be driven by social pressure (i.e., feel they should be alone) and external influence (i.e., feel forced into solitude). Previous studies have found that more self-determined motivation for solitude was linked to psychological wellbeing, such as greater self-esteem and a sense of relatedness to others (24), while the less self-determined motivation for solitude was associated with ill-being, such as loneliness, depressive symptoms, and social anxiety (24, 28).

To understand why some people spend more time alone than others, other researchers suggest that people have different *attitudes toward solitude*; that is, a person either likes to spend time in solitude or tries to avoid it. From this perspective, Burger (16) conceptualized *preference for solitude* as the tendency to either prefer spending time or doing activities alone over being with other people. Marcoen and Goossen (29) expanded such an idea and proposed two distinctive attitudes toward solitude that is the affinity for aloneness and aversion to aloneness. However, the literature that relies on conceptualization of motivation for solitude based on approach-avoidance dichotomies often found that favoring solitude over social interactions is often associated with negative outcomes. From early adolescence to late adolescence, the affinity for solitude increases, and the aversion to solitude decreases (10). Compared with those who held aversion to solitude, adolescents who held affinity for solitude were less liked by their peers, more easily victimized during peer nominations, and scored lower on friendship quantity and quality (30).

In solitude, people more often engage in some types of *activities*, because people would feel more comfortable when they do something (e.g., have an activity to choose from) than nothing when alone (e.g., think) (31). Accordingly, Ruiz-Casares (32) investigated what activities adolescents (ages 10-17 years) engage in at home alone and found that the most common solitary behaviors include watching TV, surfing the Internet, doing homework, and playing games. A recent study coded and

categorized adolescents' self-reported solitary behaviors, finding that there were three different subgroups of solitary behaviors among adolescents: thinking (e.g., daydreaming, 15.0%), passive media (e.g., passive screen and homework, 53.3%), and engaged (e.g., reading, homework, and music listening, 31.7%), with the thinking group reporting more loneliness and negative effect than those in engaged group (33).

Last but not least, the amount of *time spent alone* would also be considered as an important aspect of the adolescents' psychological implication of solitude. In earlier studies, Larson (3) first applied empirical methods (i.e., experience sampling) to investigate the effects of alone time on adolescent psychological adjustment. Specifically, it was found that spending an intermediate amount of time alone was correlated with adolescents' better adjustment than spending little or a great deal of time alone. In addition, this study suggested that when the time spent alone become an overall response tendency, it could evolve into a "misanthropy effect" that was detrimental to adolescents' mental health (3). In line with such idea, one study showed that the longer time spent alone per day would predict lower levels of adolescents' positive affect and satisfaction with life (34). However, it was also proposed that perceptions of not spending enough time alone could also be linked to adolescents' negative feelings (26).

The current study seeks to extend prior literature by exploring the different dimensions of solitude (i.e., motivation, attitudes, behaviors, and time duration) that may be configured within adolescents' solitary experience, and how such configurations may be linked to adolescents' psychological well-being and ill-being. To do this, we used latent profile analysis to examine variations in the extent to which adolescents experience solitude in their actual behaviors (i.e., solitary behavior), motivations (i.e., autonomous motivation for solitude), attitude (i.e., affinity for and aversion to aloneness), and time spent alone. Similar person-centered perspective has been used in previous research. Lay and colleagues (2) used multilevel latent profile analysis to identify two solitude groups [i.e., one positive (56.7%) and one negative (43.3%)] in adults' daily life. Maes et al. (30) adopted cluster analysis and identified six solitude groups on the basis of adolescents' loneliness (i.e., parent- and peer-related) and attitudes toward aloneness (i.e., positive and negative), with three groups displaying adaptive patterns and the other three showing maladaptive patterns. Specifically, the indifference group (17–23%, with rather low scores on the four constructs), the moderate group (18–25%, with moderately low scores on the four constructs), and the negative attitude toward aloneness group (16–21%) were considered to be adaptive. On the other hand, maladaptive pattern was found for adolescents in the peer-related loneliness group (12–19%), the parent-related loneliness group (9–16%), and the positive attitude toward aloneness group (10–14%) (30). These two findings revealed the possible heterogeneous nature of solitude and explain why some people could benefit from solitude, while others may feel lonely when being alone. However, these two person-centered studies only explored one certain dimension of solitude (i.e., cognitive effort thought, attitudes toward solitude) with the combination of the solitary affection, with neither of them considering other dimensions of solitude, such as motivation, behavior, and time.

Given the limitation of previous studies, the present study focused on four dimensions of solitude that have been studied in solitude literature, including motivation and attitudes toward solitude, and behaviors and time duration in solitude. We expected that at least one group would adjust well to solitude, that is, those who exhibit high autonomous motivation for solitude, high solitary behavior (i.e., engage in activities instead of doing nothing), and moderate time duration for being alone. At least one another group may suffer from solitude, exhibiting low autonomous motivation for solitude, high aversion to aloneness, low solitary behavior, and high time duration for being alone. Although these general trends were expected, the nature of latent profile analysis precluded specific hypotheses about the numbers of groups and precise descriptions of these groups.

Further, relatively little attention has been given to the implications of being in different solitude profiles. As such, the second goal of this study was to determine how these different profiles relate to adolescents' psychological adjustment (i.e., loneliness, depressive symptoms, and basic needs satisfactions). It was anticipated that adolescents who had a positive experience in solitude would have higher levels of psychological adjustment, whereas those who suffered from being alone were expected to have a lower level of psychological adjustment.

2. Materials and methods

2.1. Participants and procedures

Participants were enrolled in their freshman and sophomore years at three universities in Shanghai, China. The study procedure was approved by the Shanghai Normal University. A web platform, Wenjuanxing, was used to collect data. A total of 444 students were invited to participate in this study with an informed consent form on their psychology course. The consent rate was 79.95%, and the final sample includes 355 adolescents (155 male and 200 female, $M_{age} = 19.71$, $SD_{age} = 1.02$). Overall, 70% of adolescents came from urban areas of China, and 45% reported both of their parents having a bachelor's degree or more. Participants who completed the survey received additional course credit.

2.2. Measurement

2.2.1. Solitary behavior

Participants were asked how often they take part in different behaviors when they are alone on a 5-point scale (from 1 = "never" to 5 = "always"). The average score of the responses was calculated, with higher scores indicating more frequency of activities when adolescents spend time alone. The items of this measure partially came from previous findings in children (25) and adolescents (33), and semi-structured interviews were conducted to expand the diversity of solitary behavior among Chinese late adolescents. The interviews were conducted with a sample of 12 Chinese late adolescents (aged between 18 and 20 years). According to the interviews, some of the previous items were combined with new items to create an adolescent solitary behavior measure.

This measure was pilot tested with a sample of 228 Chinese late adolescents (84 male and 144 female, M_{age} =19.69, SD_{age} = 1.02) in similar geographic areas (i.e., universities in Shanghai, China) to the large majority of participants in the current sample. Items were revised or replaced based on theoretical considerations (21) and statistical issues in exploratory factor analysis (35), yielding the current measure. According to the previous theoretical suggestion (21), the four factors in adolescent solitary behavior measure were defined as self-reflection (seven items, e.g., "When I am alone, I would like to think about my future"), problem-solving (four items, e.g., "When I am alone, I would like to complete my homework"), physical activities (four items, e.g., "When I am alone, I would like to go to the gym"), and leisure browsing (four items, e.g., "When I am alone, I would like to browse social networks"), respectively (see items details in Appendix Table). To further confirm the construct of this measure, confirmatory factor analyses (CFA) were conducted in the current sample ($N = 355$). The CFA model yielded a good fit ($\chi^2(144) = 297.36$, $p < 0.01$, CFI = 0.94, RMSEA = 0.05, 90% CI [0.04, 0.06], SRMR = 0.06), with the loading ranging from 0.91 to 0.40. The internal reliabilities were 0.91, 0.87, 0.72, and 0.71 for self-reflection, problem-solving, physical activities, and leisure browsing, respectively, in the current sample.

2.2.2. Motivation for solitude

We measured motivation for solitude using the 8-item revised Self-Regulation Questionnaire (36) developed by Nguyen et al. (24). Participants were asked about the reason for solitude (eight items, e.g., "I spend time alone because I value time alone as an important part of my day"). All the items used a seven-point scale, ranging from 1 (not at all true) to 7 (very true). The results of CFA indicated that the good structural validity ($\chi^2(12)$ =30.38, $p < 0.01$, CFI = 0.98, RMSEA = 0.07, 90% CI [0.04, 0.09], SRMR = 0.02) and the internal reliability was 0.70 in the current study. As followed by previous practice (24), a Relative Autonomy Index (RAI) was calculated (24), with higher scores indicating more autonomous motivation for spending time alone.

2.2.3. Attitude toward aloneness

The Loneliness and Aloneness Scale for Children and Adolescence [LACA; (37)] was used to measure adolescents' attitudes toward solitude. Two subscales captured aversion to aloneness (LACA-negative, e.g., "When I am bored, I feel lonesome") and affinity for aloneness (LACA-positive, e.g., "Being alone makes me take up my courage again"). All the items used a 4-point scale, ranging from 1 (never) to 4 (often). The average score of the responses was calculated, with higher scores indicating more negative or more positive attitudes toward being alone. The measure has been used and proved to be reliable and valid in Chinese samples (38). The results of CFA in the current sample indicated good structural validity ($\chi^2(53) = 117.39$, $p < 0.01$, CFI = 0.95, RMSEA = 0.06, 90% CI [0.04, 0.07], SRMR = 0.05). Internal reliabilities were 0.89 and 0.79 for each subscale in the present study.

2.2.4. Time spent alone

Two questions were used to measure the participants' time spent alone, referring to previous practice (26), "In the past week (7 days), how many times did you spend time alone by yourself for at least 15 minutes? (from "1 = not once" to "6 = more than 4 times a day" and "In the past week (7 days), approximately how long did you spend time alone? (from "1 = less than 7 h (less than 1 h per day)" to "6 = more than 35 h (more than 5 h per day)." The average score of the two questions was calculated as the time spent alone. Consistent with the previous study (26), these two items were highly correlated ($r = 0.65$, $p < 0.001$) and the internal reliability was 0.79 in the current study.

2.2.5. Loneliness

The UCLA Loneliness Scale (39) was used to measure adolescents' loneliness as one of the indicators of psychological maladjustment. Participants were asked about their experience of loneliness in 2 weeks (10 items, e.g., "I feel no one to talk to."). All the items used a 4-point scale, ranging from 1 (never) to 4 (always). The average score of the responses was calculated, with higher scores indicating greater loneliness. Previous studies have shown that the scale has good reliability and validity among Chinese late adolescents (12). The results of CFA indicated a good structural validity of the UCLA Loneliness Scale for the current sample ($\chi^2(34) = 118.20$, $p < 0.01$, CFI = 0.93, RMSEA = 0.08, 90% CI [0.07, 0.10], SRMR = 0.05). In addition, the internal reliability for loneliness was 0.89 in the present study.

2.2.6. Depressive symptoms

The Beck Depression Inventory-II [BDI-II, (40)] was used to examine the depressive symptoms of the participants. The scale consisted of 20 items (e.g., "I feel like a total failure."), which used a 4-point scale, with higher scores indicating higher levels of depression. The scale was widely used in the Chinese cultural context and had high reliability (41). The results of CFA indicated a good structural validity of BDI for the current sample ($\chi^2(170) = 273.45$, $p < 0.01$, CFI = 0.94, RMSEA = 0.04, 90% CI [0.03, 0.05], SRMR = 0.05). The internal reliability for depression in this study was 0.90.

2.2.7. Basic psychological needs

The Basic Psychological Needs Scale (BPNS) (42) was used to examine whether the individuals' basic psychological needs were met and was revised into the Chinese version in a previous study (43). The scale consisted of 19 items that captured three basic psychological needs, which were competency needs (e.g., "I have recently been able to learn interesting new skills"), autonomy needs (e.g., "I am usually very happy to express my thoughts and opinions"), and related needs (e.g., "I really like the people I get along with"), respectively. All items were graded on a 7-point Likert scale, with higher scores indicating that the basic psychological needs were satisfied better. The scale had shown high reliability in the Chinese sample (44). The results of CFA indicated an acceptable structural validity of the BPNS for the current sample ($\chi^2(114) = 332.61$, $p < 0.01$, CFI = 0.90, RMSEA = 0.07, 90% CI [0.06, 0.08],

10.3389/fpsyt.2023.1173441

TABLE 1 Descriptive statistics and bivariate correlations for study variables ($N = 355$).

	1	2	3	4	5	6	7	8	9	10	11
1. Self–reflection	–										
2. Problem–solving	0.30**	–									
3. Physical activities	0.26**	0.09	–								
4. Leisure browsing	0.20**	0.40**	−0.07	–							
5. Autonomous motivation (RAI)	0.15**	0.27**	−0.02	0.14**	–						
6. Affinity for aloneness	0.39**	0.25**	0.02	0.15**	0.34**	–					
7. Aversion to Aloneness	0.12**	−0.09	0.01	0.06	−0.41**	0.02	–				
8. Time spent alone	0.08	0.19**	−0.01	0.06	0.17**	0.31**	−0.01	–			
9. Loneliness	0.24**	−0.03	−0.04	0.04	−0.30**	0.24**	0.58**	0.18**	–		
10. Depressive symptoms	0.23**	−0.06	−0.15**	0.18**	−0.13**	0.22**	0.29**	0.17**	0.46**	–	
11. Basic needs satisfaction	−0.08	0.22**	0.16**	0.01	0.25**	−0.20**	−0.32**	−0.21**	−0.55**	−0.46**	–
M	3.15	3.56	1.83	3.66	11.55	2.68	2.26	3.48	2.06	1.52	4.5
SD	0.81	0.75	0.72	0.68	10.64	0.59	0.73	1.49	0.62	0.44	0.63
Range	1–5	1–5	1–5	1–5	– 36–36	1–4	1–4	1–6	1–4	1–4	1–7

**$p < 0.01$. RAI, Relative Autonomy Index.

SRMR = 0.04). The internal reliability for psychological needs in this study was 0.82.

2.3. Statistical analysis

Latent profile analysis (LPA) was conducted to investigate how the observed heterogeneity in a group can be traced back to underlying homogeneous subgroups (or profiles) (45). This person-centered approach is based on the characteristics of indicators to identify different types of profiles and determines which profile an individual belongs to with a certain degree of probability (46). Compared with traditional clustering methods (e.g., k means clustering, hierarchical clustering), this probability-based mixture model outperformed in detecting potential classifications (47). In the current study, the profiles were identified based on eight variables on adolescents' solitude (see Figure 1 for more details). Specifically, we used solitary behavior (i.e., self-reflection, problem-solving, physical activities, leisure browsing), autonomous motivation for solitude (i.e., solitude RAI), attitude toward aloneness (i.e., affinity and aversion), and time alone as indices to describe adolescents' solitude experience. All eight variables were assessed using standardized units to facilitate interpretation.

As suggested by Nylund, Asparouhov, and Muthén (48), the bootstrap likelihood ratio test (BLRT), the adjusted BIC (aBIC), the adjusted Lo–Mendell–Rubin likelihood ratio test (LMRT), the Bayesian Information Criterion (BIC), and Akaike's Information Criterion (AIC) were considered as the model fit indices to determine the number of latent profiles in the present analysis. A high level of entropy indicates a greater accuracy of classification (49). A lower level of AIC, BIC, or aBIC indicates a better fitting model (48). In addition, BLRT and LMRT allow examining whether including one more latent profile significantly improves the model fit. If this is not the case, the more parsimonious model with fewer latent profiles should be selected (50). In selecting the final model, we took into consideration how well a solution could be interpreted, that is, whether the latent profiles in a solution showed logical patterns, were distinct from the other profiles, and could readily be labeled.

Finally, once the number of profiles has been determined, multivariate analysis of variance (MANOVA) was performed to see how the profiles varied from one another for each indicator. BCH analysis (51) was used in *Mplus* to examine the difference in adolescents' psychological adjustment outcomes (i.e., loneliness, depressive symptoms, basic needs satisfaction) across profiles.

3. Results

3.1. Descriptive analyses of main variables

Descriptive statistics and intercorrelations among all study variables are presented in Table 1. Moderate significant correlations were found between loneliness, depressive symptoms, and basic needs satisfaction, suggesting that these three variables could be viewed as indicators to measure adolescents' psychological maladjustment. Self-reflection was positively correlated with autonomous motivation for solitude, attitude toward solitude (affinity and aversion), loneliness, and depressive symptoms. Problem-solving was positively correlated with autonomous motivation for solitude, affinity for aloneness, time spent alone, and basic needs satisfaction. Physical activities were positively correlated with basic needs satisfactions and negatively correlated with depressive symptoms. Leisure browsing was positively correlated with autonomous motivation for solitude, an affinity for aloneness, and depressive symptoms. In addition, autonomous motivation for solitude was positively correlated with an affinity for aloneness and negatively correlated with an aversion to aloneness. Time spent alone was positively correlated with autonomous

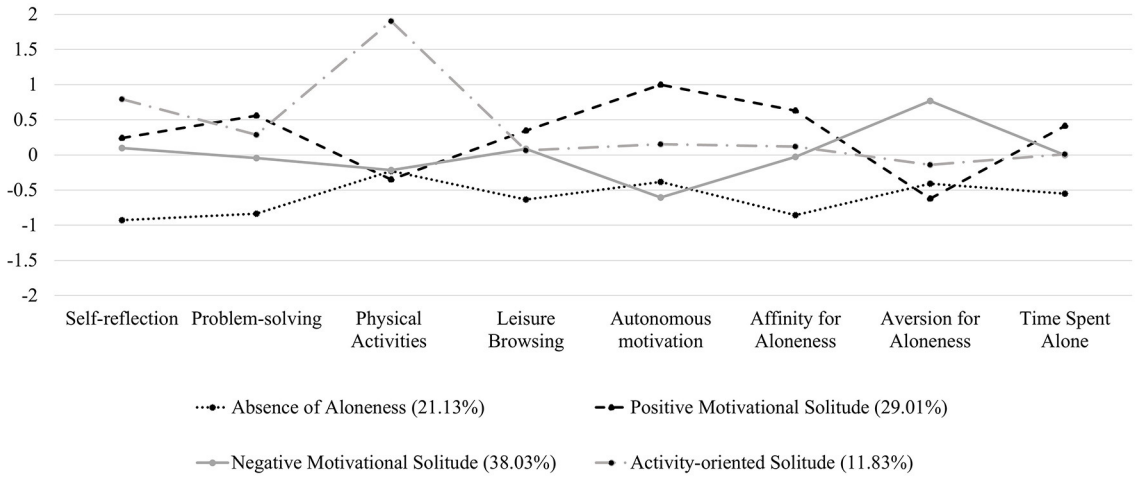


FIGURE 1
Response patterns across 8 variables for solitude profiles.

motivation for solitude and an affinity for aloneness but had no association with aversion to aloneness.

3.2. Adolescents' solitude latent profile identification

Table 2 shows the fit indices of the different profile models of LPA. The decline of AIC and aBIC plateaued after four profiles, and BIC increased after four profiles. The BLRT remained significant with the increasing profiles, and the LMR-LRT reached insignificance with five profiles, suggesting that the five-profile model did not fit better than the four-profile model. Besides, the indices of classification quality (Entropy) suggested a better separation of individuals into four profiles compared with three or five profiles. Accordingly, the four-profile solution was deemed optimal. MANOVA was conducted for eight solitary indicators to detect between-profile differences, and the result is presented in Table 3. The *post-hoc* analyses (LSD) revealed that adolescents in different profiles had significant differences in their classification variables. The latent profile parameters and the profile-conditional parameters (the standardized values of solitary activities, motivation, attitude, and time) are shown in Figure 1.

The four solitary latent profiles are described and named according to the salient features exhibited by the observed indicators, as follows: (1) **absence of aloneness profile** (Profile 1, 21.13%) was characterized by the lowest levels on all indicators of solitude (except aversion to solitude) compared with other three groups, showing that the participants of the profile would spend little time alone. (2) **positive motivational solitude profile** (Profile 2, 29.01%) was characterized by the highest level of autonomous motivation, an affinity for aloneness, time spent alone, and problem-solving, implying that participants of this profile would prefer solitude to intrinsic motivation and be possible to solve problems. (3) **negative motivational solitude profile** (Profile 3, 38.03%) was characterized by the highest level of aversion to aloneness and the lowest level of autonomous motivation, which displayed that participants of this profile may dislike being alone but have to stay alone for extrinsic reasons. (4) **activity-oriented solitude profile** (Profile 4, 11.83%) was characterized by the highest level of physical activities and self-reflection.

3.3. Differences between latent profiles in psychological adjustment

With respect to the psychological adjustment, we examined the difference between each latent profile (Table 4). The results of BCH analyses indicated significant differences between groups. Specifically, the loneliness of the *negative motivational solitude* group was significantly higher than those in the remaining three groups, whereas adolescents in the *absence of aloneness* group obtained the lowest loneliness. In addition, there were no significant differences in loneliness between adolescents in the *positive motivational solitude* and *activity-oriented solitude* groups.

A similar pattern has been found in the other indices of psychological maladjustment, adolescents in the *negative motivational solitude* group obtained the highest level of depressive symptoms than the other three groups, whereas adolescents in the *absence of aloneness* group and the *activity-oriented solitude* group obtained the lowest level of depressive symptoms than the other two groups. In addition, adolescents in the *positive motivational solitude* group scored higher on the level of depressive symptoms than adolescents in the *activity-oriented solitude* group.

Finally, adolescents in the *negative motivational solitude* group exhibited the lowest level of basic needs satisfaction than the rest of the three groups, and there were no differences in the level of basic needs satisfaction among the remaining groups.

4. Discussion

The cost and benefit of solitude have long been researched in developmental studies. Owing to the complex and multifaceted characteristics of solitude, the current study embraced a person-centered approach to offer a new perspective on solitude among late adolescents. We aimed to first identify the naturally existing

10.3389/fpsyt.2023.1173441

TABLE 2 Latent profile models and fit indices.

Profile	Proportions based on the estimated model entropy (%)						Entropy	AIC	BIC	aBIC	*p* LMRT	*p* BLRT
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6						
1	-	-	-	-	-	-		8083.56	8145.51	8094.75	-	-
2	48.45%	51.55%	-	-	-	-	0.62	7907.95	8004.75	7925.44	0.036	<0.0001
3	21.69%	43.94%	34.37%	-	-	-	0.68	7830.37	7962.02	7854.16	0.009	<0.0001
4	**21.13%**	**29.01%**	**38.03%**	**11.83%**	-	-	**0.74**	**7756.14**	**7922.64**	**7786.23**	**0.005**	**<0.0001**
5	19.16%	15.78%	39.72%	11.55%	13.80%	-	0.73	7739.71	7941.06	7776.09	0.381	<0.0001
6	17.47%	13.80%	42.82%	11.27%	13.52%	3.66%	0.76	7729.69	7965.89	7772.37	0.573	0.072

Values in bold type indicate the chosen model in the current study.

AIC, Akaike information criterion; BIC, Bayesian information criterion; aBIC, the adjusted Bayesian information criterion; LMR, Lo–Mendell–Rubin likelihood ratio test; BLRT, bootstrapped likelihood ratio test.

solitude group in Chinese late adolescents and to determine to what extent adolescents' behavior, motivation, attitude, and time when being alone would perform within a solitude profile. In addition, the second goal was to explore the association between different profiles and adolescents' psychological adjustment. Four distinct profiles were identified via latent profile analysis, and their prevalence was documented.

First, it was found that, among the four profiles, only the *negative motivational solitude* group experienced psychological maladjustment (i.e., high levels of loneliness, depressive symptoms, and low levels of basic needs satisfaction). Adolescents in this profile showed the highest level of aversion to solitude and the lowest level of autonomous motivation for solitude, suggesting the possibility that they disliked being alone but had to be alone. In the current sample, adolescents in this profile may not accept their current state of being alone, consider solitude to be worthless, and may also not believe that they were capable of being alone. Based on self-determination theory (27), non-self-determined experiences would put individuals at risk for psychological maladjustment. Previous studies have also shown that not self-determined solitude can lead to loneliness and other psychological problems (52). It was noteworthy that this profile accounted for 38.03% of the sample, with the highest percentage among those four profiles, supporting the view that solitude was risky and should be avoided to some extent for adolescents (53).

Further, the present study found that there was more than one answer regarding the extent to which adolescents could benefit from solitude. Two profiles were both correlated with good psychological adjustment, while they had different characteristics. Adolescents in the *positive motivational solitude* profile exhibited the highest level of autonomous motivation, an affinity for aloneness, the time spent alone, and problem-solving, suggesting that they may voluntarily prefer solitude and were more likely to solve problems when being alone. This group represented around 30% of our sample. Similar results were found in another study (30), in which early adolescents exhibited a preference for solitude, accounting for 30.36% and 26.10% in the two samples. Consistent with previous findings (24), people tend to benefit from solitude for autonomous motivation and are not disturbed by intrusive negative thoughts. However, when we attempt to understand the well-adjusted psychological outcomes of these motivation-driven groups, it is also noteworthy to combine with the interpretation of attitude toward solitude in our findings. Specifically, previous studies have found that a preference for solitude was associated with loneliness and psychological maladjustment among *early* adolescents (38, 54). In the current study, the affinity for aloneness was exhibited together with autonomous motivation for solitude, which brought well psychological outcomes for *late* adolescents. Such finding suggested that, on the one hand, the hypothetical framework of developmental time effect of solitude (9) has been supported. Older adolescents are troubled less when they prefer to be alone. On the other hand, the person-centered approach helped us find the significance of combining motivation and behavior to interpret attitudes toward solitude among late adolescents.

A newly found well-adapted group was labeled as the *activity-oriented solitude* group, which was characterized as the highest level of solitary behaviors (i.e., physical activities and self-reflection). This group encompassed around 12% of the sample and had

10.3389/fpsyt.2023.1173441

TABLE 3 Results of descriptive data for each group and *post-hoc* comparisons (MANOVA).

	SR	PS	PA	LB	AM	AFA	ATA	TSA
Absence of aloneness	2.32 (0.57)$_a$	2.89 (0.65)$_a$	1.68 (0.54)$_b$	3.22 (0.68)$_a$	7.92 (7.99)$_b$	2.14 (0.43)$_a$	1.89 (0.47)$_a$	2.55 (1.22)$_a$
Positive motivational solitude	3.34 (0.75)$_b$	4.01 (0.66)$_d$	1.56 (0.44)$_a$	3.93 (0.66)$_c$	22.41 (6.62)$_d$	3.06 (0.56)$_c$	1.78 (0.59)$_a$	4.10 (1.46)$_c$
Negative motivational solitude	3.26 (0.66)$_b$	3.51 (0.63)$_b$	1.70 (0.52)$_b$	3.67 (0.62)$_b$	4.51 (7.55)$_a$	2.65 (0.47)$_b$	2.86 (0.55)$_c$	3.46 (1.41)$_b$
Activity-oriented solitude	3.81 (0.62)$_c$	3.78 (0.56)$_c$	3.24 (0.50)$_c$	3.71 (0.52)$_{bc}$	14.07 (8.75)$_c$	2.76 (0.50)$_b$	2.12 (0.55)$_b$	3.71 (1.42)$_{bc}$

SR, Self-reflection; PS, Problem-Solving; PA, Physical Activities; LB, Leisure Browsing; AM, Autonomous Motivation; AFA, Affinity for aloneness; ATA, Aversion to aloneness; TSA, Time spent alone. Different subscripts in the same column indicate significant differences from one another (p <0.05); a < b < c < d.

the lowest proportion of all profiles, suggesting a relatively small proportion of adolescents that may exhibit such characteristics when they spent time alone. Such a result echoed previous findings (31) to some extent, suggesting that people may enjoy doing mundane external activities more than doing nothing when they spend time alone. The positive relationship between exercise and mental health has been widely supported in previous findings (55), thus, it is not difficult to understand why late adolescents in this group are well-adjusted. Although there was no direct evidence in previous studies about exercise alone, researchers found that leisure activities, such as hiking and walking in the wild, were involved in an individual's solitary experience (56). As such, the emergence of the activity-oriented solitude group may indicate specific types of behaviors that adolescents can engage in to have a positive experience when alone.

Finally, although the current research has focused on adolescents' experiences of being alone, a profile characterized by low levels of solitude was identified. We named this group as the *absence of aloneness*, as it showed the lowest score in seven of the eight solitary indicators. This profile represented 21.13% of the sample, which was consistent with previous findings (30). Specifically, a group of adolescents were found, showing a low affinity for solitude and a low aversion to solitude, accounting for 23.08%, 24.27%, and 16.96% in three different samples. Such findings could be interpreted as there being a group of adolescents who neither like nor hate solitude and rarely choose to be alone. Their daily life may be filled with interpersonal activities in general, and therefore, they are more well adjusted than other groups. However, it should be noted that, because we did not measure the level of adolescents' social interactions in the current study, the absence of aloneness cannot be directly equated with having a more active social life. Instead, it is possible that adolescents in the absence of aloneness group may have ambivalent attitudes toward their alone time because the possibility of being alone is relatively low in their life. At least for this sample, we did not observe evidence suggesting that the lack of any intention or attitudes toward solitude yields negative wellbeing consequences for late adolescents.

5. Limitation and future direction

In this study, we considered solitude as a multifaceted structure and applied a person-centered approach to identify four solitary profiles. The proportion of the negative motivational solitude profiles and the possible manifestations of solitude were revealed. Besides, we also discovered two profiles that may benefit from solitude and their characteristics. The study enriches and integrates previous findings to some extent and also provides new perspectives for understanding the phenomenon of solitude among Chinese late adolescents.

TABLE 4 Comparison of psychological adjustments among different solitude groups *M* (*SD*).

	Loneliness	Depressive symptoms	Basic needs satisfactions
Absence of aloneness	1.70 (0.47)$_a$	1.35 (0.34)$_a$	4.58 (0.60)$_b$
Positive motivational solitude	1.87 (0.53)$_b$	1.50 (0.41)$_b$	4.62 (0.69)$_b$
Negative motivational solitude	2.43 (0.57)$_c$	1.68 (0.49)$_c$	4.28 (0.51)$_a$
Activity-oriented solitude	1.95 (0.62)$_b$	1.35 (0.30)$_a$	4.75 (0.72)$_b$

Different subscripts in the same column indicate significant differences from one another (p < 0.05), a < b < c.

However, there are several limitations in the present study. First, considering the developmental time effect of solitude (9) from early to late adolescents, future studies may consider applying a person-centered approach at different developmental stages of adolescence (e.g., early and middle) to further explore the possible heterogeneous nature of solitude and its relationship with adolescents' developmental outcomes.

In line with such an idea, a developmental perspective could also offer us more information on the paradox of solitude in future. The current study applied a cross-sectional design, and little was known about dynamic developmental changes in solitude among adolescents. From the developmental perspective, more research questions remain to be answered. For example, do those distinct solitude groups perform the same across developmental stages of adolescence? What factors would predict the profiles' generations and possible transition?

In addition, although model parsimony, interpretability, and underlying theoretical logic were taken into consideration to select the final model, it is noteworthy that the entropy of 0.74 in our study did not meet the optimum size of 0.8 (57). Therefore, more studies are required to duplicate the findings of the current study.

Finally, the environmental context should be considered when we interpreted the current findings. In other words, these four distinct solitude groups were identified in the context of urban Chinese culture. As such, the categorizations or the

specific performance of solitary groups may vary in different contexts, such as west and east or urban and rural. Accordingly, more diverse research designs, including cross-cultural or cross-region studies, are needed to further explore the implications of solitude.

6. Implications

By approaching a person-centered research, the current study sheds light on the cost and benefit of solitude among Chinese late adolescence. The findings have practical implications for individuals, families, and schools. For instance, as we revealed two profiles that may benefit from solitude, adolescents could engage in more activities voluntarily, especially physical activities, when spending time alone. Furthermore, the study focuses on late adolescence, which corresponds to the developmental stage, especially of university freshmen and sophomores. During this period, adolescents often experience a paradoxical phase characterized by a struggle between peer interaction and solitude. As the current findings suggest adolescents in the absence of aloneness group showed the lowest level of psychological maladjustment and the highest level of basic psychological needs satisfaction, it is crucial for schools and parents to properly guide adolescents in understanding and embracing solitude and self-exploration, enhancing their social skills, and thereby safeguarding their mental health.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by Research Ethics Review Board at Shanghai Normal University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

TZ, DL, and JL conceptualized the study and developed methods, ethical documentation, and study materials. TZ recruited participants and collected data. TZ and LL drafted the manuscript. TN, DL, and JL conducted the proofreading. JL funded the current project and supervised the whole manuscript writing process. All authors contributed to the article and approved the submitted version.

Funding

This research reported here was supported by the STI 2030—Major Projects 2021ZD0200500.

Acknowledgments

We are grateful to the adolescents for their participation.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2023.1173441/full#supplementary-material

References

1. Long CR, Averill JR. Solitude: an exploration of benefits of being alone. *J Theory Soc Behav.* (2003) 33:21–44. doi: 10.1111/1468-5914.00204

2. Lay JC, Pauly T, Graf P, Biesanz JC, Hoppmann CA. By myself and liking it? Predictors of distinct types of solitude experiences in daily life. *J Pers.* (2019) 87:633–47. doi: 10.1111/jopy.12421

3. Larson RW. The emergence of solitude as a constructive domain of experience in early adolescence. *Child Dev.* (1997) 68:80–93. doi: 10.2307/1131927

4. Wang JM. Preference-for-solitude and depressive symptoms in Chinese adolescents. *Pers Individ Dif.* (2016) 100:151–6. doi: 10.1016/j.paid.2015.09.033

5. Smetana JG, Campione-Barr N, Metzger A. Adolescent development in interpersonal and societal contexts. *Annu Rev Psychol.* (2006) 57:255–84. doi: 10.1146/annurev.psych.57.102904.190124

6. Nelson LJ, Millett MA. Social Withdrawal During Emerging Adulthood. In: Coplan RJ, JC Bowker JC, Nelson LJ editors. *The Handbook of Solitude: Psychological Perspectives on Social Isolation, Social Withdrawal, and the Experience of Being Alone.* 2nd ed. New York, NY: Wiley Blackwell Press (2021). p. 146–62.

7. Bowker JC, Rubin KH, Coplan RJ. Social Withdrawal. In: Levesque RJR, editor. *Encyclopedia of Adolescence.* Cham: Springer International Publishing (2016). p. 1-14.

8. Larson RW. The solitary side of life: An examination of the time people spend alone from childhood to old age. *Dev Rev.* (1990) 10:155–83. doi: 10.1016/0273-2297(90)90008-r

9. Coplan RJ, Ooi LL, Baldwin D. Does it matter when we want to be alone? Exploring developmental timing effects in the implications of unsociability new ideas. *Psychol.* (2019) 53:47–57. doi: 10.1016/j.newideapsych.2018.01.001

10. Danneel S, Maes M, Vanhalst J, Bijttebier P, Goossens L. Developmental change in loneliness and attitudes toward aloneness in adolescence. *J Youth Adolesc.* (2018) 47:148–61. doi: 10.1007/s10964-017-0685-5

11. Heine SJ, Lehman DR, Markus HR, Kitayama S. Is there a universal need for positive self-regard? *Psychol Rev.* (1999) 106:766–94. doi: 10.1037/0033-295x.106.4.766

12. Ren L, Han X, Li D, Hu F, Mo B, Liu J. The association between loneliness and depression among Chinese college students: affinity for aloneness and gender as moderators. *Eur J Dev Psychol.* (2021) 18:382–95. doi: 10.1080/17405629.2020.1789861

13. Chen WY, Yan L, Yuan YR, Zhu XW, Zhang YH, Lian SL. Preference for solitude and mobile phone addiction among chinese college students: the mediating role of psychological distress and moderating role of mindfulness. *Front Psychol.* (2021) 12:511. doi: 10.3389/fpsyg.2021.750511

14. Nelson LJ. Going it alone: comparing subtypes of withdrawal on indices of adjustment and maladjustment in emerging adulthood. *Soc Dev.* (2013) 22:522–38. doi: 10.1111/j.1467-9507.2012.00671.x

15. Chen X, Fu R, Li D, Liu J. Developmental trajectories of shyness-sensitivity from middle childhood to early adolescence in china: contributions of peer preference and mutual friendship. *J Abnorm Child Psychol.* (2019) 47:1197–209. doi: 10.1007/s10802-018-00507-0

16. Burger JM. Individual differences in preference for solitude. *J Res Pers.* (1995) 29:85–108. doi: 10.1006/jrpe.1995.1005

17. Katz JC, Buchholz ES. "I did it myself": the necessity of solo play for preschoolers. *Early Child Dev Care.* (1999) 155:39–50. doi: 10.1080/0030443991550104

18. Bauer, D, Shanahan, M. Modeling complex interactions: Person-centered and variable-centered approaches. In: Little TD, Bovaird JA, Card NA, editors. *Modeling contextual effects in longitudinal studies*. Mahwah, NJ: Erlbaum Press (2007). p. 255–284.

19. Coplan RJ, Ooi LL, Rose-Krasnor L, Nocita G. 'I want to play alone': assessment and correlates of self-reported preference for solitary play in young children. *Infant Child Dev.* (2014) 23:229–38. doi: 10.1002/icd.1854

20. Lee S. *A Study on Exploring People's Affinity for Solitude*. [dissertation]. [Texas A&M (TX)]: University of Texas A&M. (2013).

21. Long CR, Seburn M, Averill JR, More TA. Solitude experiences: varieties, settings, and individual differences. *Pers Soc Psychol Bull.* (2003) 29:578–83. doi: 10.1177/0146167203029005003

22. Wisne PL. *A Study on The Nature of Solitude*. [dissertation]. [California School of Professional Psychology (CA)]: School of California Professional Psychology. (1978).

23. Chua SN, Koestner R, A. self-determination theory perspective on the role of autonomy in solitary behavior. *J Soc Psychol.* (2008) 148:645–7. doi: 10.3200/socp.148.5.645-648

24. Nguyen TT, Werner KM, Soenens B. Embracing me-time: motivation for solitude during transition to college. *Motiv Emot.* (2019) 43:571–91. doi: 10.1007/s11031-019-09759-9

25. Galanaki EP, Mylonas K, Vogiatzoglou PS. Developmetrics Evaluating voluntary aloneness in childhood: initial validation of the children's solitude scale. *Eur J Dev Psychol.* (2015) 12:688–700. doi: 10.1080/17405629.2015.1071253

26. Coplan RJ, Hipson WE, Archbell KA, Ooi LL, Baldwin D, Bowker JC. Seeking more solitude: conceptualization, assessment, and implications of aloneliness. *Pers Individ Dif.* (2019) 148:17–26. doi: 10.1016/j.paid.2019.05.020

27. Ryan RM, Deci EL. Self-determination theory: Basic psychological needs in motivation, development, and wellness. New York, NY: Guilford Publications. (2017).

28. Thomas V, Azmitia M. Motivation matters: development and validation of the motivation for solitude scal—Short form (MSS-SF). *J Adolesc.* (2019) 70:33–42. doi: 10.1016/j.adolescence.2018.11.004

29. Marcoen A, Goossens L. Loneliness, attitude toward aloneness, and solitude - Age differences and developmental significance during adolescence. In: Jackson S, Rodriguez-Tomé H, editors. *Adolescence and its social worlds*. NJ: Erlbaum Press (1993). p. 197-227.

30. Maes M, Vanhalst J, Spithoven AWM, Van den Noortgate W, Goossens L. Loneliness and attitudes toward aloneness in adolescence: a person-centered approach. *J Youth Adolesc.* (2016) 45:547–67. doi: 10.1007/s10964-015-0354-5

31. Wilson TD, Reinhard DA, Westgate EC, Gilbert DT, Ellerbeck N, Hahn C, et al. Just think: the challenges of the disengaged mind. *Science.* (2014) 345:75–7. doi: 10.1126/science.1250830

32. Ruiz-Casares M. "When it's just me at home, it hits me that i'm completely alone": an online survey of adolescents in self-care. *J Psychol.* (2012) 146:135–53. doi: 10.1080/00223980.2011.604361

33. Hipson WE, Coplan RJ, Dufour M, Wood KR, Bowker JC. Time alone well spent? A person-centered analysis of adolescents' solitary activities. *Soc Dev.* (2021) 30:1114–30. doi: 10.1111/sode.12518

34. Nguyen TT, Ryan RM, Deci EL. Solitude as an approach to affective self-regulation. *Pers Soc Psychol Bull.* (2018) 44:92–106. doi: 10.1177/0146167217733073

35. Yong A, Pearce S, A. Beginner's guide to factor analysis: focusing on exploratory factor analysis. *Tutor Quant Methods Psychol.* (2013) 9:79–94. doi: 10.20982/tqmp.09.2.p079

36. Ryan RM, Connell JP. Perceived locus of causality and internalization: examining reasons for acting in two domains. *J Pers Soc Psychol.* (1989) 57:749–61. doi: 10.1037/0022-3514.57.5.749

37. Marcoen A, Goossens L, Caes P. Loneliness in Pre-through late adolescence: exploring the contributions of a multidimensional approach. *J Youth Adolesc.* (1987) 16:561–77. doi: 10.1007/bf02138821

38. Maes M, Wang JM, Van den Noortgate W, Goossens L. Loneliness and attitudes toward being alone in Belgian and Chinese adolescents: examining measurement invariance. *J Child Fam Stud.* (2016) 25:1408–15. doi: 10.1007/s10826-015-0336-y

39. Russell D, Peplau LA, Ferguson ML. Developing a measure of loneliness. *J Pers Assess.* (1978) 42:290–4. doi: 10.1207/s15327752jpa4203_11

40. Beck AT, Steer RA, Ball R, Ranieri WF. Comparison of beck depression inventories-IA and -II in psychiatric outpatients. *J Pers Assess.* (1996) 67:588–97. doi: 10.1207/s15327752jpa6703_13

41. Zhang YX, Wang Y, Qian MY. Reliability and validity of back depression inventory (BDI) examined in Chinese samples. *Chin Ment Health J.* (1990) 4:22–6.

42. Gagne M. The role of autonomy support and autonomy orientation in prosocial behavior engagement. *Motiv Emot.* (2003) 27:199–223. doi: 10.1023/a:1025007614869

43. Liu J, Lin L, Lv Y, Wei C, Zhou Y, Chen X. Reliability and validity of the Chinese version of the Basic Psychological Needs Scale. *Chin Ment Health J.* (2013) 27:791–5. doi: 10.3969/j.issn.1000-6729.2013.10.014

44. Zhong H, Liu Y. Mediation effect of basic psychological needs on relationship between perceived autonomy support and happiness among undergraduates. *Chin J Public Health.* (2019) 35:223–5. doi: 10.11847/zgggws1119961

45. Hickendorff M, Edelsbrunner PA, McMullen J, Schneider M, Trezise K. Informative tools for characterizing individual differences in learning: Latent class, latent profile, and latent transition analysis. *Learn Individ Differ.* (2018) 66:4–15. doi: 10.1016/j.lindif.2017.11.001

46. Spurk D, Hirschi A, Wang M, Valero D, Kauffeld S. Latent profile analysis: A review and "how to" guide of its application within vocational behavior research. *J Vocat Behav*. (2020) 3:120. doi: 10.1016/j.jvb.2020.103445

47. Cleland CM, Rothschild L, Haslam N. Detecting latent taxa: Monte Carlo comparison of taxometric, mixture model, and clustering procedures. *Psychol Rep.* (2000) 87:37–47. doi: 10.2466/pr0.87.5.37-47

48. Nylund KL, Asparoutiov T, Muthén BO. Deciding on the number of classes in latent class analysis and growth mixture modeling: a Monte Carlo simulation study. *Struct Equ Modeling.* (2007) 14:535–69. doi: 10.1080/10705510701575396

49. Jung T, Wickrama KAS. An introduction to latent class growth analysis and growth mixture modeling. *Soc Personal Psychol Compass.* (2008) 2:302–17. doi: 10.1111/j.1751-9004.2007.00054.x

50. Tekle FB, Gudicha DW, Vermunt JK. Power analysis for the bootstrap likelihood ratio test for the number of classes in latent class models. *Adv Data Anal Classif.* (2016) 10:209–24. doi: 10.1007/s11634-016-0251-0

51. Bolck A, Croon M, Hagenaars J. Estimating latent structure models with categorical variables: one-step versus three-step estimators. *Polit Anal.* (2004) 12:3–27. doi: 10.1093/pan/mph001

52. van Zyl CJJ, Dankaert E, Guse T. Motivation for solitude: a cross-cultural examination of adolescents from collectivist and individualist cultures in South Africa. *J Child Fam Stud.* (2018) 27:697–706. doi: 10.1007/s10826-017-0916-0

53. Sullivan HS. *The Interpersonal Theory of Psychiatry*. New York: Norton Press. (1953).

54. Wang JM, Rubin KH, Laursen B, Booth-LaForce C, Rose-Krasnor L. Preference-for-solitude and adjustment difficulties in early and late adolescence. *J Clin Child Adolesc Psychol.* (2013) 42:834–42. doi: 10.1080/15374416.2013.794700

55. Penedo FJ, Dahn JR. Exercise and well-being: a review of mental and physical health benefits associated with physical activity. *Curr Opin Psychiatry.* (2005) 18:189–93. doi: 10.1097/00001504-200503000-00013

56. Hall TE. Hikers' Perspectives on Solitude and Wilderness. *Int J Wildern.* (2001) 7:20–4.

57. Lubke G, Muthén BO. Performance of factor mixture models as a function of model size, covariate effects, and class-specific parameters. *Struct Equ Modeling.* (2007) 14:26–47. doi: 10.1207/s15328007sem1401_2

frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 12 July 2023
DOI 10.3389/fpsyg.2023.1193915

OPEN ACCESS

EDITED BY
Junsheng Liu,
East China Normal University, China

REVIEWED BY
Jessica Grady,
The University of the Pacific, United States
Nejra van Zalk,
Imperial College London, United Kingdom

*CORRESPONDENCE
Kenneth H. Rubin
krubin@umd.edu

RECEIVED 27 March 2023
ACCEPTED 22 June 2023
PUBLISHED 12 July 2023

CITATION
Druskin LR, Novick DR, Smith KA, Chronis-Tuscano A, Wagner NJ, Pham S, Fleece HM, Danko CM and Rubin KH (2023) Comparison of behaviorally inhibited and typically developing children's play behaviors in the preschool classroom.
Front. Psychol. 14:1193915.
doi: 10.3389/fpsyg.2023.1193915

Comparison of behaviorally inhibited and typically developing children's play behaviors in the preschool classroom

Lindsay R. Druskin[1], Danielle R. Novick[2,3], Kelly A. Smith[4], Andrea Chronis-Tuscano[2], Nicholas J. Wagner[5], Stephanie Pham[4], Hailey M. Fleece[6], Christina M. Danko[2] and Kenneth H. Rubin[4]*

[1]Department of Psychology, West Virginia University, Morgantown, WV, United States, [2]Department of Psychology, University of Maryland, College Park, MD, United States, [3]Yale Child Study Center, Yale School of Medicine, New Haven, CT, United States, [4]Department of Human Department & Quantitative Methodology, University of Maryland, College Park, MD, United States, [5]Department of Psychological & Brain Sciences, Boston University, Boston, MA, United States, [6]Department of Counseling, Higher Education, and Special Education, University of Maryland, College Park, MD, United States

Introduction: Behavioral inhibition (BI) is a temperamental trait characterized by a bias to respond with patterns of fearful or anxious behavior when faced with unfamiliar situations, objects, or people. It has been suggested that children who are inhibited may experience early peer difficulties. However, researchers have yet to systematically compare BI versus typically developing children's observed asocial and social behavior in familiar, naturalistic settings.

Method: We compared the in-school behaviors of 130 ($M = 54$ months, 52% female) highly inhibited preschoolers (identified using the parent-reported Behavioral Inhibition Questionnaire) to 145 ($M = 53$ months, 52% female) typically developing preschoolers. Both samples were observed on at least two different days for approximately 60 min. Observers used the *Play Observation Scale* to code children's behavior in 10-s blocks during free play. Teachers completed two measures of children's behavior in the classroom.

Results: Regression models with robust standard errors controlling for child sex, age, and weekly hours in school revealed that preschoolers identified as BI engaged in significantly more observed reticent and solitary behavior, and less social play and teacher interaction than the typically developing sample. Children with BI also initiated social interaction with their peers and teachers less often than their counterparts who were not inhibited. Teachers reported that children identified as BI were more asocial and less prosocial than their non-BI counterparts.

Discussion: Significantly, the findings indicated that inhibited children displayed more solitude in the context of familiar peers. Previous observational studies have indicated behavioral differences between BI and *unfamiliar* typical age-mates in *novel* laboratory settings. Children identified as BI did not receive fewer bids for social interaction than their typically developing peers, thereby suggesting that children who are inhibited have difficulty capitalizing on opportunities to engage in social interaction with familiar peers. These findings highlight the need for early intervention for children with BI to promote social engagement, given that the frequent expression of solitude in preschool has predicted such negative outcomes as peer rejection, negative self-regard, and anxiety during the elementary and middle school years.

KEYWORDS

behavioral inhibition, solitude, peer interactions, temperament, anxiety, preschoolers

1. Introduction

Behavioral inhibition (BI) is a temperamental style characterized by a bias to respond with vigilant patterns of fearful or anxious responses when exposed to unfamiliar situations, objects, or people (Kagan et al., 1988; Fox et al., 2005). Behavioral inhibition can be reliably measured as early as infancy, and it is estimated that 15–20% of children present with BI (Degnan and Fox, 2007).

Researchers have reported that BI is manifested by a variety of behaviors at different ages. Significantly, researchers have demonstrated that there exists continuity from laboratory assessments of BI in infancy to observed fearfulness in the face of *unfamiliar* objects, adults, and toddlers at two-years, and subsequently to specific forms of social withdrawal expressed in the company of *unfamiliar* peers during the preschool and early elementary school years (e.g., Fox et al., 2001; Rubin et al., 2002; Henderson et al., 2004; Degnan et al., 2008; Kiel and Buss, 2011; Buss et al., 2013; Brooker et al., 2016). Toddlers who have been identified as behaviorally inhibited display fewer smiling, speaking, and approach behaviors than their age-mates who are not inhibited when in the presence of unfamiliar objects and adults (Garcia Coll et al., 1984). During the preschool years, children who are behaviorally inhibited require longer "warm up" periods before approaching or initiating play with unfamiliar children and adults (Kagan et al., 1987). When observed during free play in a laboratory setting with unfamiliar age-mates who are not behaviorally inhibited, inhibited preschoolers have been found to display more *reticent* behavior (watching peers from afar; being unoccupied) and to engage in more solitary activity (Rubin et al., 2002; Henderson et al., 2004) than their non-inhibited age-mates.

As noted above, the extant evidence base has focused largely on BI in the context of novel situations and unfamiliar peers (see Rubin et al., 2009, 2018 for reviews). Researchers have consistently demonstrated links between BI, as assessed during infancy and toddlerhood, and observed displays of social *reticence* in groups of *unfamiliar* peers in preschool-, kindergarten- and early elementary-aged children (e.g., Fox et al., 2001; Rubin et al., 2002; Henderson et al., 2004; Degnan et al., 2008). Furthermore, *in laboratory settings*, elevated BI in early childhood has been shown to predict less observed interpersonal behavior (e.g., the display of fewer positive social initiations/reactions, less time spent in social play) and poorer social skills (e.g., incompetent social problem-solving skills) during the elementary school years (Nelson et al., 2005; Walker et al., 2014; Penela et al., 2015). These findings underscore how the socially avoidant tendencies of inhibited children may impede proficiency in the age-appropriate social skills derived from engagement with peers.

The developmental cascade from BI to social withdrawal has been captured in a conceptual model that has guided much of the current research on the predictors, concomitants, and consequences of BI in infants, preschoolers, and school-age youth (Rubin and Chronis-Tuscano, 2021; see Rubin et al., 1991 for a review). Briefly, within this conceptual model, BI, as assessed in the infant and toddler years, serves as an early predictor of anxiogenic parental behaviors (e.g., oversolicitousness and overprotectiveness). For example, in the case of oversolicitous parenting, parents may interrupt social situations where children would have the opportunity to experience challenges because they may believe that children are unable to navigate social difficulties without parental support (Rubin et al., 1997). Kiel et al. (2015) also identified curvilinear associations between parental encouragement and children's separation anxiety, such that overly protective maternal behavior or overly encouraging behavior (i.e., to the point of intrusiveness) was related to greater separation anxiety in inhibited children. Moreover, in the aforementioned model it is proposed that the resulting lack of sufficient opportunities to engage in novel social experiences places children who are inhibited on a trajectory leading to broad impairment in both unfamiliar settings as well as in situations that are experienced on a daily basis. For example, BI has been posited to predict displays of social withdrawal (solitude) in the preschool setting. In turn, the model suggests, and research has supported the notion that social withdrawal among *familiar* peers predicts deficits in perspective–taking and interpersonal problem-solving skills (e.g., Rubin and Krasnor, 1986; Stewart and Rubin, 1995). These latter deficits, as evidenced in the elementary and middle school years, have been posited, in the conceptual model, and supported in extant research, to predict peer rejection, the consequent development of negative self-appraisals of one's social competence and relationships, and ultimately, rejection sensitivity and social anxiety during early adolescence (Rubin et al., 1991; Rubin and Chronis-Tuscano, 2021). Indeed, this latter outcome has been supported by research demonstrating that young children who are characterized as being highly inhibited are at increased risk for the later development of social anxiety disorder, which in and of itself is associated with a host of functional impairments throughout adolescence and adulthood (Chronis-Tuscano et al., 2009; Muris et al., 2011; Clauss and Blackford, 2012).

Traditionally, researchers have observed children and their parents in the laboratory setting to identify children high in BI. Furthermore, as noted above, behavioral continuities of BI have been assessed, almost exclusively, within contexts comprising unfamiliar peers (see Rubin et al., 2018 for a relevant review). For example, Kagan (1989) developed a paradigm in which caregivers and their children are placed in an unfamiliar room to engage in unstructured play. While the dyad is playing, an unfamiliar adult enters the room to allow researchers the opportunity to observe children's reactions, including their hesitancy to interact with the novel adult and toys, frequency of social approach behaviors, and proximity to and interactions with their caregiver (Kagan, 1989; Stifter et al., 1989). In studies of preschool, kindergarten, and elementary school-age children, the consequences of toddler BI have often been assessed by observing children in quartets of unfamiliar peers (e.g., Henderson et al., 2004; Degnan et al., 2008). When laboratory observations are not used, researchers employ a variety of parent- and teacher-report measures to capture BI and conceptually similar constructs in young children (e.g., shyness, social withdrawal, social anxiety), such as the *Behavioral Inhibition Questionnaire* (Bishop et al., 2003), the *Preschool Anxiety Scale* (Spence et al., 2001), and the *Colorado Child Temperament Inventory* (Rowe and Plomin, 1977). However, researchers have noted discrepancies between parent and teacher ratings of BI children, such that both parent and teacher ratings only moderately converge with observational ratings of children's behavior in the laboratory (Ballespí et al., 2012), thus highlighting the importance of multi-informant and multi-modal measurement. Moreover, given the pivotal role that positive and negative peer interactions play in the aforementioned developmental

cascade model toward child social outcomes (Rubin et al., 2009; Rubin and Chronis-Tuscano, 2021), it is imperative to not only observe inhibited children's reactions in the face of novelty, but also within the peer/social contexts in which their social difficulties may actually ensue.

In one of the few studies to examine associations between laboratory assessments of BI and school-based assessments of social withdrawal, Tarullo et al. (2011) found that compared to preschool-age children high in exuberance (e.g., high activity levels, stimulation-seeking, and risk-seeking), laboratory-identified inhibited preschoolers were observed to experience fewer positive peer interactions, engage in more watching/wandering behavior, interact more with the teacher, and display less positive affect and more anxious/vigilant and sad affect within the familiar setting of the classroom (Tarullo et al., 2011). Although this seminal study highlighted inhibited preschoolers' unique social experiences within the familiar peer setting, the authors noted that only a relatively small number of children were actually identified as temperamentally inhibited. This disclosure may limit the generalizability and conclusions that can be drawn from the findings. Moreover, the children who were inhibited were compared to a sample of children with highly exuberant temperaments. This latter group may well display markedly different social behaviors/interactions than an unselected sample of children. As such, a replication and extension of these findings is warranted in which a larger sample of inhibited children is compared with an unselected sample of same-age peers within a naturalistic setting.

Also warranted is an examination of the extent to which one of the most frequently used measures of BI, the *Behavioral Inhibition Questionnaire* (BIQ; Bishop et al., 2003), can distinguish between those preschoolers who are identified as highly inhibited from those who represent a "typical" sample vis-a-vis their observed behavior in a school setting populated by familiar peers. Thus, we sought to compare observed and teacher-reported behaviors of children who are behaviorally inhibited with those who are typically developing in their preschool classrooms. We did so by recruiting a reasonably large sample of preschoolers who had been identified, by parent assessments on the BIQ, as highly inhibited and compared their classroom behaviors with an unselected sample of same-age children. Based on prior findings (e.g., Tarullo et al., 2011), we hypothesized that the children identified as highly inhibited would display more solitude as well as less group play compared to their typically developing peers. As previous studies have highlighted low activity levels in children identified as shy and anxious (Poole and Schmidt, 2018), we expected that children identified as inhibited would display less rough-and-tumble play (i.e., playful physical contact, roughhousing, or pretend fighting with peers; Rubin, 1982) compared to their typically developing classmates. Furthermore, we hypothesized that children identified as inhibited would make fewer social initiations to, and receive fewer social initiations from, their classmates and teachers as early inhibition has been shown to predict less social competence and prosociality with peers (Bohlin et al., 2005). We also assessed teacher-reports of child behavior. We hypothesized that preschool teachers would assess the highly inhibited preschoolers as being more solitary, anxious, and excluded by their peers and less prosocial and aggressive relative to their typically developing age-mates.

2. Materials and methods

2.1. Procedure

Two samples of children were recruited for the study. The first sample comprised a group of children identified as highly behaviorally inhibited (see Sample 1 description below); the second sample comprised a group of children who were matched in age to Sample 1 (see Sample 2 description below). All children fell between the ages of 45–64 months ($n = 275$). They were recruited through community organizations (e.g., schools, daycare centers, pediatrician offices) in the surrounding Washington, DC metropolitan area. Exclusionary criteria included current engagement in anxiety-focused treatment, a diagnosis of autism spectrum disorder or a score at or below the clinical cutoff on the Social Communication Questionnaire (SCQ; Eaves et al., 2006), or a diagnosis (or suspected diagnosis) of selective mutism. Additionally, current enrollment in a preschool/daycare program was required for study participation.

A telephone screen to assess eligibility was completed with parents who expressed interest in participating in the study. A primary parent was identified to complete demographic information and assessments online *via* Qualtrics software. Written informed consent was obtained from all parents. After obtaining informed consent from families, school administrators and teachers were contacted for permission to complete school-based observations of children enrolled in the study. Teachers of participating children also completed questionnaires to assess children's behavior in the school setting. Trained study personnel conducted 30-min observations of each child during free play in the school setting on each of two separate days. Study materials and procedures were approved by the research team's university Institutional Review Board. Parents and teachers were compensated for the completion of questionnaires. Data were collected between 2015 to 2020.

2.2. Participants

2.2.1. Sample 1 – behaviorally inhibited sample

One hundred thirty children ($n = 130$; $M = 54$ months, $SD = 5.73$) comprised Sample 1. The sample included 68 girls (52.3%) and 62 boys (47.7%). Children from this sample were recruited as part of a larger randomized controlled trial examining early intervention programs for children high in BI (Chronis-Tuscano et al., 2022; ClinicalTrials.gov registration: NCT02308826). The current study uses *baseline* data from this preregistered intervention study. For inclusion in this sample, children had to score in the 85th percentile or above on the *Behavioral Inhibition Questionnaire* (Bishop et al., 2003).

2.2.2. Sample 2 – typically developing sample

One hundred forty-five children ($n = 145$; $M = 53$ months, $SD = 5.33$) were included in Sample 2. The sample comprised 76 girls (52.4%) and 69 boys (47.6%). Children in this sample were recruited for the purpose of comparing the BI sample to typically developing children unselected for BI.

2.3. Measures

2.3.1. Demographic variables

Prior to completing the school observations, parents provided demographic information (e.g., sex, age, race, and ethnicity) for themselves and their child (Table 1). Parents also indicated the total time that their child spent in school each week to control for variations in types of school schedules (e.g., full-day vs. extended-day programs).

2.3.2. Behavioral inhibition questionnaire

The *Behavioral Inhibition Questionnaire* (BIQ; Bishop et al., 2003) was used as the primary measure of *parent-reported* child BI. The BIQ is a psychometrically sound (Kim et al., 2011) 30-item caregiver-rating scale that assesses children's responses to novel situations across six domains: adults, peers, performance demands, novel settings, physical challenges, and parental separation. Parents rated child behavior on a 7-point Likert-type scale from 1 (*Hardly ever*) to 7 (*Almost always*). The BIQ provides a score indicative of social inhibition (comprising the adults, peers, and performance demands subscales) and a score that captures BI in novel and unfamiliar situations (comprising the novel settings, physical challenges, and parental separation subscales). A total BI score can be calculated by summing all items. Scores that fall above 132 (i.e., the top 15% of scores) are within the highly inhibited range based on conceptual models of BI (Kagan et al., 2007). Higher scores reflect more concerns related to BI. Within the current study, reports of internal consistency were high (overall sample $\alpha = 0.96$, Sample 1 $\alpha = 0.87$, Sample 2 $\alpha = 0.95$).

2.3.3. Play observation scale

A short form of the *Play Observation Scale* (POS; Rubin, 1982) was used to assess children's social and non-social behaviors in the classroom setting. Observations began in mid-October so that children had the opportunity to acclimate to the school setting. The POS includes two elements to capture the behaviors of the child being observed (the target child): Time-sampled codes (i.e., mutually exclusive behaviors that are captured within 10-s intervals) and event-sampled codes (i.e., non-mutually exclusive behaviors that were coded each time they occurred). Time-sampled codes included five categories of child's behavior: reticence (unoccupied and observing/onlooking others from afar); solitary behavior (playing at least three feet away from other children); parallel play (independent play within three feet of other children); group activity (engaging in the same activity as peers or conversing with at least one other child); and teacher interaction (conversing or engaging with a teacher or other adult in the classroom). Also coded were five event-sampled behaviors including anxious behavior (e.g., crying, whining, nail biting, automanipulative activity), positive affect (e.g., laughing), social initiations made *to peers*, social initiations received *from peers*, social initiations made *to teachers*, and social initiations received *from teachers*. To account for minor differences in the time spent observing each child, a proportion was created by dividing the number of 10-s time samples that behavior was coded by the total number of 10-s time samples that each child was observed. Senior research personnel trained staff to reliably collect the in-school POS data. Observers were required to reach high interrater reliability consisting of κ greater than 0.80 with senior research personnel on training videos. Following the completion of training using pre-recorded videos of children's play in the laboratory, research personnel were required to reach a κ equal to or greater than 0.80 during a live observation session at a local childcare facility affiliated with the university. To control for time of year, observations were dichotomously coded based on the timing during the academic year to either be a "fall" observation (i.e., occurring during the months October through

TABLE 1 Primary parent and child demographic characteristics.

Variable	Sample 1 ($n = 130$)	Sample 2 ($n = 145$)	Combined sample ($N = 275$)
Primary parent	–	–	–
Parent age in years, *M* (*SD*)	38.87 (5.35)	37.79 (5.33)	38.29 (5.37)
Parent relationship to child (% mother)	87.6	89.0	88.0
Parent marital status (%)	–	–	–
Married	89.9	93.1	90.9
Divorced/Separated	4.7	2.8	3.6
Other	5.4	4.2	5.4
Parent race (%)	–	–	–
Asian	17.7	7.6	12.4
Black or African American	13.1	4.8	8.7
White	66.2	78.6	72.7
Other	3.1	8.4	5.8
Hispanic or Latino (%)	6.9	4.9	5.8
Annual household income (USD, %)	–	–	–
$0–$24,999	3.2	0.0	1.8
$25,000–$49,999	3.2	0.0	1.8
$50,000–$74,999	4.0	7.1	5.4
$75,000–$99,999	7.1	6.1	6.7
$100,000–$124,999	17.5	11.2	14.7
$125,000–$149,999	8.7	18.4	13.0
$150,000+	56.3	57.1	56.7
Child	–	–	–
Child age in months, *M* (*SD*)	53.88 (5.73)	52.96 (5.33)	53.37 (5.53)
Child sex (% female)	52.3	52.4	52.4
Child race	–	–	–
Asian	13.1	4.9	8.8
Black or African American	11.5	5.6	8.4
White	50.8	72.2	62.0
Other	24.6	17.4	20.8
Child time in school, *M* (*SD*)*	29.16 (13.44)	26.81 (13.89)	27.97 (13.71)
Time of school observation (% fall)	41.5	37.2	39.3

*Refers to the number of hours child spent in school per week. Sample 1 = Behaviorally inhibited sample; Sample 2 = Typically developing sample.

December) or a "spring" observation (i.e., occurring during the months of February through June).

2.3.4. Child behavior scale

The *Child Behavior Scale* (CBS; Ladd and Profilet, 1996) is a teacher questionnaire used to assess social interaction in the school context. Teachers rated children's behavior on 35 items using a 3-point scale (1: *Does not apply*, 2: *Applies sometimes*, and 3: *Certainly applies*). The CBS comprises six subscales that capture peer aggression, prosocial behavior with peers (e.g., helps other children, empathetic, cooperative with peers, shows concern for moral issues), asocial behavior in the company of peers (e.g., prefers to play alone, keeps peers at a distance, withdraws from peer activities), exclusion by peers (e.g., not much liked by children, ignored by peers, not chosen as a playmate by peers, ridiculed by peers), anxious-fearful behavior, and hyperactive-distractible behavior. Within the current study, reports of internal consistency were acceptable (Cronbach's α for subscales from the overall sample ranged from α = 0.77–0.90, Sample 1 ranged from α = 0.77–0.92, Sample 2 ranged from α = 0.77–0.87).

2.3.5. Preschool play behavior scale

The *Preschool Play Behavior Scale* (PPBS; Coplan and Rubin, 2001) is an 18-item teacher-report measure designed to capture the reticent behavior (e.g., takes role of onlooker/spectator; wanders around aimlessly; watches/listens to other children without trying to join in; remains alone/unoccupied or staring into space), solitary-passive behavior (e.g., plays alone examining an object/toy; plays alone building things or with other toys; plays alone drawing/painting or doing puzzles; plays alone exploring toys/objects trying to figure out how they work), solitary-active behavior (e.g., engages in pretend play by self; plays make-believe, but not with other children), social play (e.g., talks to other children during play; engages in groups with other children (not just beside them); engages in active conversations with other children), and rough-play (e.g., rough-and-tumble play; engages in playful fighting with other children) of preschool-aged children in the classroom setting. Teachers were instructed to rate child behavior during free play periods from a scale of 1 (*Never*) to 5 (*Very often*). Within the current study, reports of internal consistency were acceptable (Cronbach's α for subscales from the overall sample ranged from 0.78–0.91, Sample 1 ranged from 0.68–0.95, Sample 2 ranged from 0.64–0.94).

2.4. Data analytic plan

Hypotheses were tested using structural equation modeling (SEM) in the *lavaan* package in R (Rosseel, 2012; R Core Team, 2013). A series of regression analyses were run to examine differences in child behavior between the behaviorally inhibited children and the typically developing group for each of the outcome variables. The direct effect of condition on teacher- and parent-reported measures as well as observed behaviors was examined. Robust full-information maximum likelihood was used to handle missing data (Enders, 2001).Theoretically relevant demographic factors [e.g., child sex, child age, total time spent in school, and time of year of the school observations (i.e., fall or spring)] were included as covariates in all analyses.

3. Results

3.1. Descriptive statistics

Preliminary analyses were conducted using SPSS version 26. Descriptive statistics by sample for all variables of interest are found in Tables 1, 2. Patterns of missingness were examined prior to running analyses. Missingness ranged from 1–19% for teacher-reported variables, and there were no missing data for observed variables.

3.2. Observational data

3.2.1. Reticence

In the model examining differences in observed child reticence, it was found that the sample of parent-reported BI children exhibited significantly more reticent behavior in their classrooms than children in the typically developing sample ($b = 0.081$, $z = 4.923$, $p < 0.001$). Predictors explained 9.6% of the variance. Child time in school was a significant covariate ($b = -0.001$, $z = -2.147$, $p < 0.001$), suggesting more time in school was related to less reticent behavior for both groups.

3.2.2. Solitary play

In the model examining differences in solitary play between the BI and typical samples, children who were inhibited exhibited significantly more solitary play in their classrooms than typically developing children ($b = 0.050$, $z = 3.028$, $p = 0.002$). Predictors explained 6.5% of the variance. Child age was a significant covariate ($b = -0.003$, $z = -2.067$, $p = 0.039$); older children engaged in less solitary play across both groups.

3.2.3. Parallel play

There were no significant group differences found in observed child parallel play ($b = 0.019$, $z = 1.455$, $p = 0.146$). Predictors explained 5.1% of the variance. Child sex was a significant covariate ($b = -0.031$, $z = -2.452$, $p = 0.014$), with boys engaging in significantly less parallel play than girls across groups. Total time spent in school ($b = -0.001$, $z = 2.948$, $p = 0.009$) was also a significant covariate, with those spending more time in school displaying less parallel play across groups.

3.2.4. Group activity

It was found that children who were behaviorally inhibited exhibited significantly less group play than children who were not inhibited ($b = -0.123$, $z = -5.214$, $p < 0.001$). Predictors explained 13.4% of the variance. Child age ($b = 0.008$, $z = 3.572$, $p < 0.001$) and total time spent in school ($b = 0.002$, $z = 2.948$, $p = 0.003$) were significant covariates, with older children and those spending more time in school engaging in more group play across groups.

3.2.5. Teacher interaction

Children who were highly inhibited exhibited significantly less teacher interaction than typical children ($b = -0.028$, $z = -2.360$, $p = 0.018$). Predictors explained 4.7% of the variance. Child age was a significant covariate ($b = -0.003$, $z = -1.987$, $p = 0.047$); younger children from both groups engaged in more interaction with their teachers.

TABLE 2 Descriptive statistics of variables of interest.

Variable	Sample 1, *M* (*SD*) (*n*=130)	Sample 2, *M* (*SD*) (*n*=145)
BIQ Total	153.36 (19.95)	98.13 (28.62)
BIQ Social Inhibition Composite	5.61 (0.80)	3.53 (1.11)
BIQ Adults Subscale	5.65 (1.35)	3.60 (1.48)
BIQ Peers Subscale	5.71 (0.95)	3.63 (1.23)
BIQ Performance Subscale	5.43 (1.14)	3.28 (1.24)
BIQ Novelty Composite	5.12 (0.84)	3.32 (1.09)
BIQ Novel Subscale	4.69 (0.83)	3.08 (0.98)
BIQ Physical Challenges Subscale	3.36 (1.43)	2.51 (1.21)
XBIQ Separation Subscale	5.14 (1.45)	3.18 (1.45)
CBS Peer Aggression Subscale	1.11 (0.27)	1.20 (0.27)
CBS Prosocial Behavior Subscale	2.18 (0.51)	2.35 (0.42)
CBS Asocial Behavior Subscale	1.63 (0.60)	1.42 (0.41)
CBS Exclusion Subscale	1.20 (0.34)	1.19 (0.29)
CBS Anxious-Fearful Subscale	1.43 (0.47)	1.42 (0.47)
CBS Hyperactive-Distractible Subscale	1.25 (0.44)	1.49 (0.56)
POS Time-Sampled Behavior	–	–
Reticence	0.22 (0.16)	0.14 (0.10)
Solitary Behavior	0.23 (0.15)	0.19 (0.13)
Parallel Play	0.22 (0.16)	0.13 (0.10)
Group Activity	0.31 (0.21)	0.42 (0.21)
Teacher Interaction	0.08 (0.08)	0.11 (0.12)
POS Event-Sampled Behavior	–	–
Anxious behavior	0.01 (0.03)	0.01 (0.04)
Positive affect	0.04 (0.04)	0.03 (0.03)
Social initiations *to peers*	0.04 (0.03)	0.04 (0.02)
Social initiations *from peers*	0.01 (0.02)	0.02 (0.02)
Social initiations *to teachers*	0.03 (0.03)	0.03 (0.02)
Social initiations *from teachers*	0.02 (0.02)	0.02 (0.01)
PPBS Reticent Behavior Subscale	2.45 (0.89)	2.19 (0.67)
PPBS Solitary-Passive Behavior Subscale	3.08 (0.78)	2.90 (0.61)
PPBS Solitary-Active Behavior Subscale	2.58 (0.97)	2.55 (0.69)
PPBS Social Play Subscale	3.46 (1.05)	4.07 (0.79)
PPBS Rough Play Subscale	1.90 (1.00)	2.13 (1.04)

BIQ, Behavioral inhibition questionnaire; CBS, Child behavior scale; POS, Play observation scale; PPBS, Preschool play behavior scale. Sample 1 = Behaviorally inhibited sample; Sample 2 = Typically developing sample.

3.2.6. Event-sampled behaviors

Unexpectedly, in the models examining group differences in event-sampled behaviors, sample was not a significant predictor of observed anxious behavior ($p = 0.288$), positive affect ($p = 0.642$), social initiations made to peers ($p = 0.349$), social initiations received from peers ($p = 0.126$), or social initiations received from teachers ($p = 0.177$).

However, it was found that children who were inhibited exhibited significantly fewer social initiations to teachers than typical children ($b = -0.029$, $z = -2.151$, $p = 0.031$). The predictors explained 4% of the variance in social initiations made to teachers.

3.3. Teacher-report comparisons

3.3.1. Preschool play behavior scale

On the PPBS, teachers rated children who were inhibited as engaging in more reticent behavior ($b = 0.290$, $SE = 0.098$, $B = 0.183$, $p = 0.003$) and more solitary activity that involved constructive activity with objects (e.g., puzzle construction; artwork; $b = 0.183$, $SE = 0.086$, $B = 0.132$, $p = 0.033$), than typical children. There were non-significant group differences in teacher ratings of child solitary active play (e.g., running aimlessly around the playroom; $b = 0.045$, $SE = 0.108$, $B = 0.027$, $p = 0.679$). Further, teachers rated typical children as engaging in more rough-and-tumble play ($b = -0.262$, $SE = 0.116$, $B = -0.127$, $p = 0.024$) and more social play involving cooperation between and conversations among peers ($b = -0.639$, $SE = 0.115$, $B = -0.329$, $p < 0.001$), compared to children who were highly inhibited.

3.3.2. Child behavior scale

On the CBS, there were significant differences between groups on several domains. Teachers rated typical children as being more aggressive ($b = -0.097$, $SE = 0.034$, $B = -0.178$, $p = 0.004$) and more prosocial ($b = -0.172$, $SE = 0.061$, $B = -0.179$, $p = 0.005$) than children who were inhibited. Additionally, teachers rated children who were inhibited as being more asocial than typical children ($b = 0.185$, $SE = 0.063$, $B = 0.183$, $p = 0.003$). However, there were no significant group differences in teacher ratings of child anxiety ($b = 0.010$, $SE = 0.062$, $B = 0.011$, $p = 0.870$) or teacher ratings of child exclusion ($b = 0.019$, $SE = 0.040$, $B = 0.030$, $p = 0.640$).

4. Discussion

Although researchers have long been reporting behavioral differences between extremely inhibited and typical children when these groups are observed in an unfamiliar setting (e.g., the laboratory) and in the company of unfamiliar peers (see Rubin et al., 2018 for a review), few studies have extended this research to the naturalistic and familiar context of the school. Moving beyond observations in laboratory settings to understand how inhibited children function in familiar contexts is essential if one is to establish support for the conceptual conjecture that BI in early childhood is linked to the display of solitude in familiar settings that, in turn, predicts subsequent difficulties in the peer group (rejection; victimization), negative thoughts and feelings about the self, and ultimately to anxiety (and more specifically, social anxiety; Rubin et al., 2009). Although the ability to regulate emotions and behavior in novel situations and contexts is crucial to optimal child development, continued adaptability in everyday social contexts is highly significant to overall child functioning. Thus, the primary aim of the current study was to examine links between a reliable and valid index of parent-reported BI (Bishop et al., 2003; Broeren and Muris, 2010; Kim et al., 2011) and observed and teacher-reported child behaviors in the preschool setting with familiar peers.

In accordance with our hypotheses and previous research, our findings revealed that children identified as highly inhibited on the parent-report BIQ were observed to engage in more reticent behavior and solitary play and in less social interaction with peers and teachers than a comparison group of typical (non-BI) age-mates. Indeed, both observational data and teacher-reports indicated that inhibited children evidenced significantly more reticence and solitude (i.e., unoccupied, observing/onlooking others from afar; solitary play) in the school setting compared to their same-aged typical peers. These findings are in accord with those reported by Tarullo et al. (2011) in a study of a much smaller sample of extremely inhibited children which was compared with a group of highly exuberant preschoolers. When conceptualized within the broader literature pertaining to laboratory-based observations of inhibited children's behaviors, our findings indicated not only that inhibited preschoolers demonstrated significantly more unoccupied/onlooker behaviors (i.e., reticence; Coplan et al., 1994), but also more solitary activity compared to their typically developing peers.

It is notable that children in the inhibited sample did not engage in less parallel play (i.e., independent play within three feet of other children) compared to their typically developing counterparts. Researchers have suggested that parallel play may be a necessary step that allows inhibited children to progress from watching others from afar or choosing to express solitude to eventually approaching others in an effort to engage in social interaction (Bakeman and Brownlee, 1980; Asendorpf, 1991). Perhaps a different observational taxonomy and the use of such statistical methods as sequential analyses may allow researchers to examine whether those inhibited children who gradually come to engage others in social interaction do, indeed, display a sequential process of observing others from afar, to approaching others and quiescently marking territory in close proximity to specific peers, to requesting that they join the activities of the desired peers.

In general, the teacher reports supported that which was observed. Thus, teachers indicated that children identified as behaviorally inhibited evidenced significantly more reticence and solitary passive (e.g., quiescent object exploration and construction) activity. No group differences emerged with regard to teacher-reported solitary active play. Given that the latter form of solitude is rather infrequently displayed during preschool free play (e.g., Rubin, 1982) the non-significant between-group difference is unsurprising.

Contrary to our hypotheses, children in the behaviorally inhibited sample did not make or receive fewer bids for social interactions than their typically developing peers. Despite these non-significant differences, it may have been that the preschoolers identified as inhibited were approaching their age-mates in a less than competent manner, thereby negating the possibility of engaging with peers in cooperative, group-oriented play. Unfortunately, our observational coding taxonomy did not distinguish between positive and negative social overtures to (and from) peers. However, in previous studies, researchers have established that inhibited and socially withdrawn preschoolers are less socially competent than their typically developing same-age peers (e.g., Rubin et al., 1991; Bohlin et al., 2005). For example, inhibited and withdrawn children have been observed to be less successful than their typically developing age-mates in being able to meet their social goals (Rubin and Krasnor, 1986; Stewart and Rubin, 1995). Furthermore, inhibited and withdrawn preschoolers have been found to be less able than their more sociable age-mates to generate competent and flexible strategies to join others in play or to establish friendships (Rubin and Krasnor, 1986). Perhaps these latter difficulties may explain why the BI children in the present sample were unable to successfully initiate sustained social interaction or to capitalize on opportunities offered by peers to engage in social play.

Lastly, it may have been possible that the bids for social interaction received by inhibited children were not for the purpose of initiating coordinated and positive social play. Thus, despite the lack of between group differences in teacher ratings of peer exclusion, it is possible that more subtle negative peer interactions are not as noticeable to teachers at this developmental stage. Notably, preschool teachers are more likely to notice physical aggression and defiance as forms of bullying, but often overlook bullying that occurs in verbal and relational forms (Tepetaş et al., 2010). Furthermore, as the children in the current study were in their first years of school, they may not have reached the point at which solitary behavior is considered, by peers, to be abnormal (Younger et al., 1993). Thus, the BI preschoolers who expressed reticent and solitary behavior in the classroom may not have been viewed as being "easy targets" for peer victimization, exclusion, and rejection (Ladd, 2006; Rubin et al., 2009) as is the case for older, elementary school-aged socially withdrawn children. To further pinpoint the emergence of this developmental transactional process, researchers would do well to examine the content and quality of inhibited and socially withdrawn children's peer interactions across time.

As expected, inhibited children were reported, by teachers, to engage in significantly less rough-and-tumble play compared to their typically developing peers. Significantly, rough-and-tumble play can be distinguished from acts of aggression in that the former is not considered to involve a goal to harm the play partner (Pellegrini, 2002). Indeed, there is a growing body of research regarding the benefits of "adventurous play" for children. More specifically, play in which children have the opportunity to take developmentally appropriate risks in a playful manner has been linked with reduced social anxiety later on in childhood (Majdandžić et al., 2018). Thus, there are clear potential benefits for supporting inhibited children's adventurous play in an effort to mitigate their already elevated risk for later social anxiety. Teachers play a critical role in increasing children's access to adventurous play, and several school-based interventions have been developed with the goal of facilitating opportunities for risk and challenge in children's play (see Nesbit et al., 2021 for a systematic review). Nevertheless, further research is needed to identify the most effective ways of supporting children's adventurous play and eliminating school-related barriers to implementing related interventions.

With regard to teacher interactions, children in the behaviorally inhibited sample spent significantly less time in play or in conversation with their teachers compared to their typically developing peers. While teachers initiated social interactions with children in both samples at similar frequencies, inhibited children made significantly fewer initiations to their teachers. Over time, if inhibited children lack the repertoire of social skills to support effective communication with their teachers, they may face challenges advocating for their needs to be met in the classroom. Difficulties vocalizing their needs to teachers may also make inhibited children more susceptible to peer victimization across the school years (Rubin et al., 2009). Indeed, researchers have shown that inhibited children lack closeness in their relationships with their teachers, even when they are engaged in fewer

personal conflicts in the classroom setting (Rudasill et al., 2006; Thijs and Koomen, 2009). Given the significant role of positive teacher-child relationships in supporting both social and academic success (Rudasill et al., 2006), it is of prime importance to improve behaviorally inhibited children's ability to connect with, and benefit from, their relationships with their teachers.

Our findings have several implications for prevention/intervention efforts for inhibited young children. First, the significant differences between inhibited and typically developing children highlight tangible opportunities for *early* intervention efforts. When inhibited children engage in less social interaction within their first years of school, they naturally encounter fewer opportunities to gain knowledge of social relationships and utilize social skills (Rubin et al., 2009). To disrupt this negative developmental process from unfolding, intervention programs would benefit from targeting inhibited children's social skills, with the goal to generalize the learned skills to the school setting, and ultimately increase positive peer and teacher interactions. Along with age-appropriate play and social skills, it may be particularly beneficial for such programs to equip inhibited children with assertive communication skills to ensure that their needs are not overlooked. Importantly, engagement in reticent or solitary-passive play may not, in and of itself, warrant intervention to mitigate the risk for developing anxiety; other factors that may underlie the expression of these behaviors must be taken into account (Coplan and Rubin, 2001). Such other child factors include the ability to regulate emotion and the ability to understand the perspectives and feelings of others. These factors must be assessed to determine whether, or which type of intervention is necessary to best support children's social and emotional development. Furthermore, teachers can play an important role in scaffolding inhibited children's social development in the classroom. In the current sample, inhibited children engaged in less group activity with peers and less teacher interaction compared to their typically developing. Teachers and other educational staff may benefit from evidence-based strategies to engage inhibited children in both adult and peer interactions. To facilitate inhibited children's social skill development and offer naturalistic opportunities for sustained social interaction, teachers may benefit from intervention/prevention efforts that incorporate social skills and associated group-based activities into the regular classroom curriculum (Coplan and Rudasill, 2016).

The current study expands on previous work in several ways. First, we discovered, for the first time, that the oft-used BIQ allows a distinction to be made between the classroom free-play behaviors of young, inhibited children and their uninhibited counterparts. Knowing that the parent-reported BIQ can distinguish between inhibited and uninhibited children's behaviors in both unfamiliar and familiar settings will be useful in the screening of children in need of intervention (e.g., *The Turtle Program* – Chronis-Tuscano et al., 2022; *The Cool Little Kids Program* – Rapee et al., 2005).

Relatedly, by comparing children with elevated BI with a sample of typically developing children in the school setting, we were able to gain insight into inhibited children's behaviors in the context of their familiar peers, rather than in an unfamiliar laboratory setting comprising groups of unacquainted children. Although BI is characterized by wariness in the context of novelty, examining children in their natural settings provides opportunities to better understand the ways in which inhibited youth's socioemotional development can be optimally supported across settings.

Furthermore, multiple informants' reports (teacher and parent) were utilized in the current study to characterize the children's behaviors, along with objective school-based observations. A multi-informant approach is essential, as child behaviors have repeatedly been shown to vary across environments and caregivers (De Los Reyes et al., 2013).

It is important to acknowledge the limitations of the current study. First, many of the children from both samples attended highly resourced preschools. As these settings are not representative of all preschools, it will be important for future researchers to take the classroom context and curriculum into account to ensure that various school formats are incorporated into the sample. Second, studies would benefit from including a measure of classroom emotional climate, which has been shown to buffer against socially withdrawn youths' experiences of peer rejection and victimization (Gazelle, 2006). Third, a measure of children's language development was not included as part of the current study. While it is possible that language delays may account for fewer social initiations to peers and teachers (e.g., Coplan and Weeks, 2009), word approximations, single words, phrases, and sentences are all sufficient for a code of social initiation to others as part of the Play Observation Scale (Rubin, 1982). Moreover, children are able to engage in collaborative group play (i.e., with a common goal or purpose) without verbal communication to receive a code of "group play" on the Play Observation Scale. Nevertheless, in the future, researchers should incorporate measures of language skills when evaluating behavioral inhibition to disentangle the constructs of verbal communication and sociality. Finally, children in the current study were measured at one timepoint in their school classrooms. As peer experiences in the classroom setting may impact behavior across time (Almas et al., 2011), in the future, would do well to assess child behavior at multiple timepoints.

In sum, the goal of the current study was to compare the in-school behaviors of two distinct groups of preschoolers – one comprising typical children and the other comprising children identified as dispositionally behaviorally inhibited. The study was designed to establish whether BI was associated with the display of solitude in the company of familiar peers. Indices of BI were drawn from parents and trained observers. Findings from the present study suggested that children high in BI differed from typically developing children in the extent to which they were observed to engage in social reticence and solitude in the school setting. While inhibited children engaged in more reticent and solitary behaviors and less group-based interactive play, they received similar amounts of social initiations from their classmates. The findings provide evidence for the social challenges inhibited children face in *familiar* peer contexts, and indicate that young, inhibited children may have difficulties capitalizing on their peers' advances to foster social connection. These findings have several implications for early intervention and prevention efforts, as children high in BI may require additional support from parents and teachers to develop social skills through peer interaction.

Data availability statement

The datasets presented in this article are not readily available because of ethical and privacy restrictions. Requests to access the datasets should be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by Institutional Review Board, University of Maryland-College Park. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

LD, DN, KS, and KR contributed to the conceptualization and design of the study. LD, DN, and KS organized the database. DN and KS performed the statistical analyses. LD, DN, and KR wrote the first draft of the manuscript. NW, SP, HF, CD, and AC-T reviewed and edited this manuscript. LD, DN, KS, SP, HF, and CD were responsible for project administration. KR and AC-T designed the original study and acquired the funding for this project. All authors contributed to the article and approved the submitted version.

Funding

This project was funded by a grant from NIH R01MH103253-01 awarded to AC-T and KR.

Acknowledgments

The authors would like to thank the participating families, teachers, and school administrators that made this study possible. The authors would also like to thank the study personnel and research assistants from the University of Maryland Laboratory for the Study of Child and Family Relationships for their years of hard work and dedication to this project.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Almas, A. N., Phillips, D. A., Henderson, H. A., Hane, A. H., Degnan, K. A., Moas, O. L., et al. (2011). The relations between infant negative reactivity, non-maternal childcare, and children's interactions with familiar and unfamiliar peers. *Soc. Dev.* 20, 718–740. doi: 10.1111/j.1467-9507.2011.00605.x

Asendorpf, J. B. (1991). Development of inhibited children's coping with unfamiliarity. *Child Dev.* 62, 1460–1474. doi: 10.1111/j.1467-8624.1991.tb01618.x

Bakeman, R., and Brownlee, J. R. (1980). The strategic use of parallel play: a sequential analysis. *Child Dev.* 51, 873–878. doi: 10.2307/1129476

Ballespí, S., Jané, M. C., and Riba, M. D. (2012). Who should report abnormal behavior at preschool age? The case of behavioral inhibition. *Child Psychiatry Hum. Dev.* 43, 48–69. doi: 10.1007/s10578-011-0250-5

Bishop, G., Spence, S. H., and McDonald, C. (2003). Can parents and teachers provide a reliable and valid report of behavioral inhibition? *Child Dev.* 74, 1899–1917. doi: 10.1046/j.1467-8624.2003.00645.x

Bohlin, G., Hagekull, B., and Andersson, K. (2005). Behavioral inhibition as a precursor of peer social competence in early school age: the interplay with attachment and nonparental care. *Merrill-Palmer Q.* 51, 1–19. https://www.jstor.org/stable/23096047. doi: 10.1353/mpq.2005.0001

Broeren, S., and Muris, P. (2010). A psychometric evaluation of the behavioral inhibition questionnaire in a non-clinical sample of Dutch children and adolescents. *Child Psychiatry Hum. Dev.* 41, 214–229. doi: 10.1007/s10578-009-0162-9

Brooker, R. J., Kiel, E. J., and Buss, K. A. (2016). Early social fear predicts kindergarteners' socially anxious behaviors: direct associations, moderation by inhibitory control, and differences from nonsocial fear. *Emotion* 16, 997–1010. doi: 10.1037/emo0000135

Buss, K. A., Davis, E. L., Kiel, E. J., Brooker, R. J., Beekman, C., and Early, M. C. (2013). Dysregulated fear predicts social wariness and social anxiety symptoms during kindergarten. *J. Clin. Child Adolesc. Psychol.* 42, 603–616. doi: 10.1080/15374416.2013.769170

Chronis-Tuscano, A., Degnan, K. A., Pine, D. S., Perez-Edgar, K., Henderson, H. A., Diaz, Y., et al. (2009). Stable early maternal report of behavioral inhibition predicts lifetime social anxiety disorder in adolescence. *J. Am. Acad. Child Adolesc. Psychiatry* 48, 928–935. doi: 10.1097/CHI.0b013e3181ae09df

Chronis-Tuscano, A., Novick, D. R., Danko, C. M., Smith, K., Wagner, N. J., Wang, C. H., et al. (2022). Early intervention for inhibited young children: a randomized controlled trial comparing the turtle program and cool little kids. *J. Child Psychol. Psychiatry* 63, 273–281. doi: 10.1111/jcpp.13475

Clauss, J. A., and Blackford, J. U. (2012). Behavioral inhibition and risk for developing social anxiety disorder: a meta-analytic study. *J. Am. Acad. Child Adolesc. Psychiatry* 51, 1066–1075.e1. doi: 10.1016/j.jaac.2012.08.002

Coplan, R. J., and Rubin, K. H. (2001). Exploring and assessing nonsocial play in the preschool: the development and validation of the preschool play behavior scale. *Soc. Dev.* 7, 72–91. doi: 10.1111/1467-9507.00052

Coplan, R. J., Rubin, K. H., Fox, N. A., Calkins, S. D., and Stewart, S. L. (1994). Being alone, playing alone, and acting alone: distinguishing among reticence, and passive, and active solitude in young children. *Child Dev.* 65, 129–137. doi: 10.1111/j.1467-8624.1994.tb00739.x

Coplan, R.J., and Rudasill, K.M. (2016). *Quiet at school*. New York: Teachers' College Press.

Coplan, R. J., and Weeks, M. (2009). Shy and soft-spoken: shyness, pragmatic language, and socio-emotional adjustment in early childhood. *Infant Child Dev.* 18, 238–254. doi: 10.1002/icd.622

De Los Reyes, A., Henry, D. B., Tolan, P. H., and Wakschlag, L. S. (2013). Linking informant discrepancies to observed variations in young children's disruptive behavior. *J. Abnorm. Child Psychol.* 37, 637–652. doi: 10.1007/s10802-009-9307-3

Degnan, K. A., and Fox, N. A. (2007). Behavioral inhibition and anxiety disorders: multiple levels of a resilience process. *Dev. Psychopathol.* 19, 729–746. doi: 10.1017/S0954579407000363

Degnan, K. A., Fox, N. A., Henderson, H. A., Rubin, K. H., and Nichols, K. (2008). Predicting social wariness in middle childhood: the moderating roles of childcare history, maternal personality and maternal behavior. *Soc. Dev.* 17, 471–487. doi: 10.1111/j.1467-9507.2007.00437.x

Eaves, L. C., Wingert, H. D., Ho, H. H., and Mickelson, E. C. R. (2006). Screening for autism spectrum disorders with the social communication questionnaire. *J. Dev. Behav. Pediatr.* 27, S95–S103. doi: 10.1097/00004703-200604002-00007

Enders, C. K. (2001). The performance of the full information maximum likelihood estimator in multiple regression models with missing data. *Educ. Psychol. Meas.* 61, 713–740. doi: 10.1177/0013164401615001

Fox, N. A., Henderson, H. A., Marshall, P. J., Nichols, K. E., and Ghera, M. M. (2005). Behavioral inhibition: linking biology and behavior within a developmental framework. *Annu. Rev. Psychol.* 56, 235–262. doi: 10.1146/annurev.psych.55.090902.141532

Fox, N. A., Henderson, H. A., Rubin, K. H., Calkins, S. D., and Schmidt, L. A. (2001). Continuity and discontinuity of behavioral inhibition and exuberance:

psychophysiological and behavioral influences across the first four years of life. *Child Dev.* 72, 1–21. doi: 10.1111/1467-8624.00262

Garcia Coll, C., Kagan, J., and Reznick, J. S. (1984). Behavioral inhibition in young children. *Child Dev.* 55, 1005–1019. doi: 10.2307/1130152

Gazelle, H. (2006). Class climate moderates peer relations and emotional adjustment in children with an early history of anxious solitude: a child × environment model. *Dev. Psychol.* 42, 1179–1192. doi: 10.1037/0012-1649.42.6.1179

Henderson, H. A., Marshall, P. J., Fox, N. A., and Rubin, K. H. (2004). Psychophysiological and behavioral evidence for varying forms and functions of nonsocial behaviors in preschoolers. *Child Dev.* 75, 251–263. doi: 10.1111/j.1467-8624.2004.00667.x

Kagan, J. (1989). "The concept of behavioral inhibition to the unfamiliar" in *Perspectives on behavioral inhibition*. ed. J. S. Reznick (Chicago: University of Chicago Press), 1–23.

Kagan, J., Reznick, J. S., and Snidman, N. (1987). The physiology and psychology of behavioral inhibition in children. *Child Dev.* 58, 1459–1473. doi: 10.2307/1130685

Kagan, J., Reznick, J. S., Snidman, N., Gibbons, J., and Johnson, M. O. (1988). Childhood derivatives of inhibition and lack of inhibition to the unfamiliar. *Child Dev.* 59, 1580–1589. doi: 10.2307/1130672

Kagan, J., Snidman, N., Kahn, V., Towsley, S., Steinberg, L., and Fox, N. (2007). The preservation of two infant temperaments into adolescence. *Monogr. Soc. Res. Child Dev.* 72, 1–95. doi: 10.1111/j.1540-5834.2007.00436.x

Kiel, E. J., and Buss, K. A. (2011). Prospective relations among fearful temperament, protective parenting, and social withdrawal: the role of maternal accuracy in a moderated mediation framework. *J. Abnorm. Child Psychol.* 39, 953–966. doi: 10.1007/s10802-011-9516-4

Kiel, E. J., Premo, J. E., and Buss, K. A. (2015). Maternal encouragement to approach novelty: a curvilinear relation to change in anxiety for inhibited toddlers. *J. Abnorm. Child Psychol.* 44, 433–444. doi: 10.1007/s10802-015-0038-3

Kim, J., Klein, D. N., Olino, T. M., Dyson, M. W., Dougherty, L. R., and Durbin, C. E. (2011). Psychometric properties of the Behavioral inhibition questionnaire in preschool children. *J. Pers. Assess.* 93, 545–555. doi: 10.1080/00223891.2011.608756

Ladd, G. W. (2006). Peer rejection, aggressive or withdrawn behavior, and psychological maladjustment from ages 5 to 12: an examination of four predictive models. *Child Dev.* 77, 822–846. doi: 10.1111/j.1467-8624.2006.00905.x

Ladd, G. W., and Profilet, S. M. (1996). The child behavior scale: a teacher-report measure of young children's aggressive, withdrawn, and prosocial behaviors. *Dev. Psychol.* 32, 1008–1024. doi: 10.1037/0012-1649.32.6.1008

Majdandžić, M., de Vente, W., Colonnesi, C., and Bögels, S. M. (2018). Fathers' challenging parenting behavior predicts less subsequent anxiety symptoms in early childhood. *Behav. Res. Ther.* 109, 18–28. doi: 10.1016/j.brat.2018.07.007

Muris, P., van Brakel, A. M., Arntz, A., and Schouten, E. (2011). Behavioral inhibition as a risk factor for the development of childhood anxiety disorders: a longitudinal study. *J. Child Fam. Stud.* 20, 157–170. doi: 10.1007/s10826-010-9365-8

Nelson, L. J., Rubin, K. H., and Fox, N. A. (2005). Social withdrawal, observed peer acceptance, and the development of self-perceptions in children ages 4 to 7 years. *Early Child. Res. Q.* 20, 185–200. doi: 10.1016/j.ecresq.2005.04.007

Nesbit, R. J., Bagnall, C. L., Harvey, K., and Dodd, H. F. (2021). Perceived barriers and facilitators of adventurous play in schools: a qualitative systematic review. *Children* 8:681. doi: 10.3390/children8080681

Pellegrini, A. D. (2002). "Rough-and-tumble play from childhood through adolescence: development and possible functions" in *Blackwell handbook of childhood social development*. eds. P. K. Smith and C. H. Hart (London: Blackwell), 438–453.

Penela, E. C., Walker, O. L., Degnan, K. A., Fox, N. A., and Henderson, H. A. (2015). Early behavioral inhibition and emotion regulation: pathways toward social competence in middle childhood. *Child Dev.* 86, 1227–1240. doi: 10.1111/cdev.12384

Poole, K. L., and Schmidt, L. A. (2018). Smiling through the shyness: the adaptive function of positive affect in shy children. *Emotion* 19, 160–170. doi: 10.1037/emo0000426

R Core Team (2013). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria.

Rapee, R. M., Kennedy, S., Ingram, M., Edwards, S., and Sweeney, L. (2005). Prevention and early intervention of anxiety disorders in inhibited preschool children. *J. Consult. Clin. Psychol.* 73, 488–497. doi: 10.1037/0022-006X.73.3.488

Rosseel, Y. (2012). Lavaan: an R package for structural equation modeling. *J. Stat. Softw.* 48, 1–36. doi: 10.18637/jss.v048.i02

Rowe, D. C., and Plomin, R. (1977). Temperament in early childhood. *J. Pers. Assess.* 41, 150–156. doi: 10.1207/s15327752jpa4102_5

Rubin, K. H. (1982). Non-social play in preschoolers: necessarily evil? *Child Dev.* 53, 651–657. doi: 10.2307/1129376

Rubin, K. H., Barstead, M. G., Smith, K. A., and Bowker, J. C. (2018). "Peer relations and the behaviorally inhibited child" in *Behavioral inhibition*. eds. K. Pérez-Edgar and N. Fox (Germany: Springer), 157–184.

Rubin, K. H., Burgess, K. B., and Hastings, P. D. (2002). Stability and social–behavioral consequences of toddlers' inhibited temperament and parenting behaviors. *Child Dev.* 73, 483–495. doi: 10.1111/1467-8624.00419

Rubin, K. H., and Chronis-Tuscano, A. (2021). Perspectives on social withdrawal in childhood: past, present, and prospects. *Child Dev. Perspect.* 15, 160–167. doi: 10.1111/cdep.12417

Rubin, K. H., Coplan, R. J., and Bowker, J. C. (2009). Social withdrawal in childhood. *Annu. Rev. Clin. Psychol.* 60, 141–171. doi: 10.1146/annurev.psych.60.110707.163642

Rubin, K. H., Hastings, P. D., Stewart, S. L., Henderson, H. A., and Chen, X. (1997). The consistency and concomitants of inhibition: some of the children, all of the time. *Child Dev.* 68, 467–483. doi: 10.2307/1131672

Rubin, K. H., Hymel, S., Mills, R. S. L., and Rose-Krasnor, L. (1991). "Conceptualizing different pathways to and from social isolation in childhood" in *Internalizing and externalizing expressions of dysfunction*. eds. D. Cicchetti and S. Toth (United States: Lawrence Erlbaum Associates, Inc), 91–122.

Rubin, K. H., and Krasnor, L. R. (1986). "Social-cognitive and social behavioral perspectives on problem solving" in *Cognitive perspectives on children's social and behavioral development. The Minnesota symposia on child psychology*. ed. M. Perlmutter, vol. *18* (Hillsdale, NJ: Erlbaum), 1–68.

Rudasill, K. M., Rimm-Kaufmann, S. E., Justice, L. M., and Pence, K. (2006). Temperament and language skills as predictors of teacher-child relationship quality in preschool. *Early Educ. Dev.* 17, 271–291. doi: 10.1016/j.ecresq.2008.12.003

Spence, S. H., Rapee, R., McDonald, C., and Ingram, M. (2001). The structure of anxiety symptoms among preschoolers. *Behav. Res. Ther.* 39, 1293–1316. doi: 10.1016/S0005-7967(00)00098-X

Stewart, S. L., and Rubin, K. H. (1995). The social problem-solving skills of anxious-withdrawn children. *Dev. Psychopathol.* 7, 323–336. doi: 10.1017/S0954579400006532

Stifter, C. A., Fox, N. A., and Porges, S. W. (1989). Facial expressivity and vagal tone in five and ten-month-old infants. *Infant Behav. Dev.* 12, 127–137. doi: 10.1016/0163-6383(89)90001-5

Tarullo, A. R., Mliner, S., and Gunnar, M. R. (2011). Inhibition and exuberance in preschool classrooms: associations with peer social experiences and changes in cortisol across the preschool year. *Dev. Psychol.* 47, 1374–1388. doi: 10.1037/a0024093

Tepetaş, G. Ş., Akgun, E., and Altun, S. A. (2010). Identifying preschool teachers' opinion about peer bullying. *Procedia Soc. Behav. Sci.* 2, 1675–1679. doi: 10.1016/j.sbspro.2010.03.964

Thijs, J., and Koomen, H. M. Y. (2009). Toward a further understanding of teachers' reports of early teacher–child relationships: examining the roles of behavior appraisals and attributions. *Early Child. Res. Q.* 24, 186–197. doi: 10.1016/j.ecresq.2009.03.001

Walker, O. L., Henderson, H. A., Degnan, K. A., Penela, E. C., and Fox, N. A. (2014). Associations between behavioral inhibition and children's social problem-solving behavior during social exclusion. *Soc. Dev.* 23, 487–501. doi: 10.1111/sode.12053

Younger, A. J., Gentile, C., and Burgess, K. B. (1993). "Children's perceptions of social withdrawal: changes across age" in *Social withdrawal, inhibition, and shyness in childhood*. eds. K. Rubin and J. Asendorpf (Hillsdale, NJ: Erlbaum), 215–236.

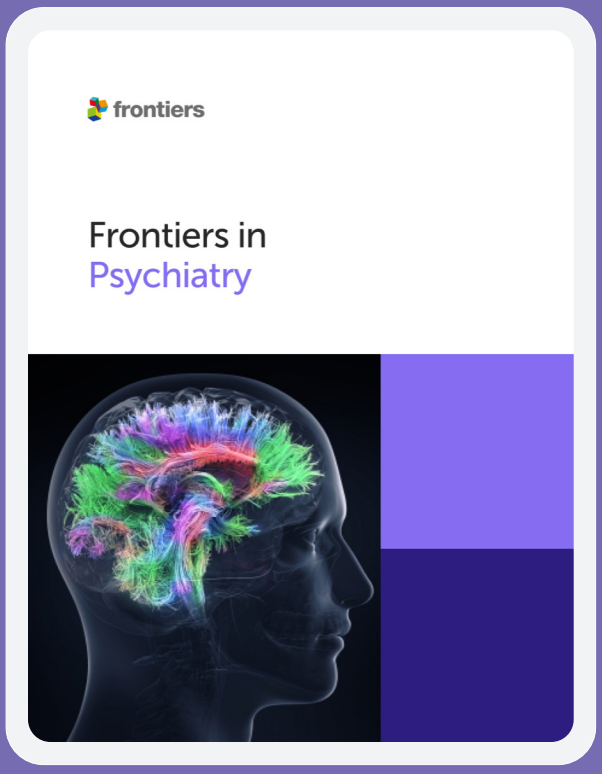
Frontiers in Psychiatry

Explores and communicates innovation in the field of psychiatry to improve patient outcomes

The third most-cited journal in its field, using translational approaches to improve therapeutic options for mental illness, communicate progress to clinicians and researchers, and consequently to improve patient treatment outcomes.

Discover the latest Research Topics

See more →



Frontiers

Avenue du Tribunal-Fédéral 34
1005 Lausanne, Switzerland
frontiersin.org

Contact us

+41 (0)21 510 17 00
frontiersin.org/about/contact