Zhou *et al. BMC Psychology* (2025) 13:327
https://doi.org/10.1186/s40359-025-02635-x

BMC Psychology

RESEARCH Open Access

A longitudinal examination of loneliness in left-behind children: the interaction between self-esteem and academic self-efficacy matters

Yutao Zhou[1,2], Chengwen Fan[1] and Shuge Zhang[1,2,3*]

Abstract

Background Loneliness can cause severe mental and physical health problems and is of particular concern among vulnerable groups such as left-behind children. Research has suggested important person-level characteristics and attributes, such as self-esteem and self-efficacy, to be protective factors of loneliness in children. However, existing research is limited in the use of a cross-sectional design and the lack of consideration of the self-esteem × self-efficacy interaction on loneliness, as well as the potential divergent effects of domain-specific (e.g., general vs. academic) self-efficacy in loneliness.

Methods We used a longitudinal design to examine the moderation role of general vs. academic self-efficacy in the influence of self-esteem on left-behind children's loneliness. In a sample of 405 left-behind children (M_{age} = 10.51, SD = 1.36; 49.6% girls), we assessed their self-esteem, general self-efficacy, academic self-efficacy and loneliness at baseline, with follow-up measure implemented to assess changes in loneliness in one year time. Longitudinal path analysis was conducted for hypothesis testing.

Results Academic self-efficacy was a more proximal predictor of loneliness at baseline and its change over time. Importantly, self-esteem predicted lowered loneliness and a more significant reduction over one year only when academic (not general) self-efficacy was high.

Conclusions A profile of high self-esteem and low academic self-efficacy appeared to be the most at-risk for loneliness in left-behind children. The findings should inform future research and policy/intervention efforts regarding strategies for addressing loneliness in left-behind children by enhancing their academic self-efficacy and closing the esteem-efficacy discrepancy.

Keywords Self-discrepancy, Domain-specific self-efficacy, Residual change, Path analysis

*Correspondence:
Shuge Zhang
zhangshuge@hut.edu.cn
[1]College of Physical Education, Hunan University of Technology, Zhuzhou, China
[2]Centre for Sport and Psycho-Social-Behavioural Research, Zhuzhou, China
[3]School of Sport and Exercise Sciences, University of Derby, Derby, UK

Introduction

Loneliness is a typical emotional response to isolation, lack of companionship, or a combination of both [1–4]. It is not merely about a sense of being alone but also rooted in the feeling of being unwanted by or unimportant to significant others [5]. Such a negative feeling can stem from various sources, including social isolation [6, 7], moving to a new location [8], or the loss of a loved one [9]. Individuals experiencing loneliness are often at risk of mental and physical health issues. For example, an increased sense of loneliness amplifies the symptoms of depression and anxiety [7] and can lead to a greater risk of cardiovascular disease [10], stroke [11], and an undermined immune system [12]. However, compared to the already substantial research investigating and addressing loneliness in older people [4, 10, 13], loneliness in vulnerable young people such as left-behind children requires more research attention [14, 15]. As such, in the present research, we aimed to examine relevant protective psychological factors and provide implications for addressing loneliness in left-behind children.

Loneliness in left-behind children

The term "left-behind children" commonly refers to children who are left to live with other relatives or guardians for a prolonged period in the absence of their parents who migrate to a different region for work or due to other issues [15]. Such a phenomenon is more prevalent in rural, remote, underdeveloped, or deprived areas [16]. Indeed, left-behind children is a greater public concern in developing (instead of developed) countries, regions, or areas where urbanisation and industrialisation have rapidly occurred and contribute to growing economic disparities between rural and urban areas [17]. Such a discrepancy in economy and income potential across different regions is considered a key antecedent of familial separation and cause of left-behind children due to parents seeking better employment opportunities outside (and usually far away from) their original place of living [18].

Considering the causes of left-behind children, especially the absence of parents or primary caregivers to those children, one would expect that left-behind children are particularly prone to loneliness [19]. Indeed, parental absence often results in a lack of emotional support and guidance, exacerbating feelings of isolation and neglect [20]. These negative impacts of parental absence account for a greater risk of exhibiting maladaptive symptoms in left-behind children, such as anxiety [21], depression [22], and conduct or behavioural problems [23], compared to their counterparts who live with their parents. Meanwhile, with high-level loneliness, left-behind children often face developmental issues, including but not limited to undermined social and interpersonal functioning [24], delayed cognitive development [25], and amplified academic challenges [26]. To alleviate loneliness and its consequences in left-behind children, research has suggested enhancing community support [27], improving guardian caregiving skills [14], and implementing policies that address the root economic causes of left-behind children [28] play a pivotal role. However, to date, knowledge of person-level psychological protective factors of loneliness in left-behind children remains scarce. As such, in the present research, we aimed to investigate the role of two important but relatively overlooked person-level characteristics and attributes, namely self-esteem [29, 30] and self-efficacy [31, 32] in the context of loneliness in left-behind children.

Self-esteem and loneliness

Self-esteem is fundamentally an individual's subjective evaluation of their own worth, encompassing beliefs about oneself and an emotional response to those beliefs [30]. In the general population, higher self-esteem is associated with better mental health [33], reduced vulnerability [34], and enhanced coping with adversities [35]. Research has unveiled the many benefits of self-esteem in children, such as fostering academic achievement [36], promoting social integration [37], and establishing psychological resilience [38]. In left-behind children, empirical evidence exists supporting a negative association between self-esteem and loneliness, which may be explained by reduced levels of anxiety and depression [39], enhanced coping [40], and greater life satisfaction [21].

Despite support for self-esteem's protection against loneliness, the literature on self-esteem and loneliness has at least two limitations that warrant attention. First, most research on self-esteem and loneliness, if not all, adopted a cross-sectional and non-interventional design and thus is unable to offer meaningful insights into the potential causal interpretation of self-esteem on loneliness. Assessing the influence of self-esteem in loneliness in more than one single time point is essential for understanding if the protection of self-esteem against loneliness is direct (i.e., due to self-esteem itself), indirect (i.e., via other underlying factors associated with self-esteem), or indeed a combination of both. Such a longitudinal approach should also enable the test of self-esteem's influence on the change in one's sense of loneliness over time. Given these considerations, we adopted a longitudinal design in the present research and examined the influence of self-esteem on left-behind children's loneliness over time.

Moreover, although the negative association between self-esteem and loneliness is relatively well-established [39, 40], less is known about factors that might moderate the self-esteem-loneliness relationship. Since an

individual's self-esteem tends to be relatively stable over time (i.e., rank-order stability) [41], but the sense of loneliness can fluctuate significantly in a short period of time [42], it is unlikely self-esteem would exert an identical or consistent influence on one's feeling of loneliness in all times. Considering self-esteem reflects an individual's person-level trait in viewing and valuing oneself [30], one could expect an akin but state-like characteristic, namely self-efficacy (i.e., one's belief in the capacity of organising and executing certain actions and achieving desired goals) [31], to magnify the benefits of self-esteem.

Self-efficacy as a potential moderator

Different to self-esteem that encompasses a broad, dispositional, and evaluative self-perception [43], self-efficacy reflects one's efficacious belief in executing certain actions that is context-specific, task-related and can be independent of one's actual ability and self-appraisal [44]. In the context of loneliness, evidence is consistent regarding the negative relationship between self-efficacy and loneliness [44–46]. However, research investigating both self-esteem and self-efficacy in left-behind children is scarce, and the potential interaction between self-esteem and self-efficacy has been overlooked. Since one's self-efficacy can foster and contribute to a sense of self-worth, especially under stressful or difficult situations [47], it is possible that the protection of self-esteem in loneliness is valid only when an individual's self-efficacy is high not low. In other words, when self-efficacy is low, individuals high in self-esteem may still be prone to loneliness because they are more likely to experience a pessimistic state about daily life due to undermined efficacious expectations. Such a proposition has yet to receive rigorous examination in existing research.

Furthermore, self-efficacy has a variety of distinguishable manifestations [48]. Among the varied forms of self-efficacy suggested by Bandura, the distinction between general self-efficacy and academic self-efficacy appears to be particularly relevant to self-esteem and loneliness in left-behind children. For comparison, *general self-efficacy* reflects a general sense of efficacious belief with regard to one's ability to cope and deal with daily hassle (e.g., solve difficult problems, accomplish goals, handle unpredicted situations) [49], whilst *academic self-efficacy* reflects more specific beliefs about one's capacities of fulfiling academic goals (e.g., getting good grades) and meeting demands (e.g., working hard on homework) in academic environment and is more proximally influenced by one's social interaction with teachers, peers, parents, and the school settings [50]. Given the meta-analytical evidence that the manifestation of left-behind children's loneliness and the related maladaptive consequences are significantly influenced by their daily academic environment and school settings [14, 15], we hypothesised that academic self-efficacy has a more prominent impact on protecting against loneliness in left-behind children, compared to general self-efficacy. We further built this prediction to extend our conceptualisation of potential moderation of self-efficacy on the self-esteem-loneliness relationship; that is, academic (compared to general) self-efficacy would amplify the protection of self-esteem on loneliness in left-behind children to a greater level.

The present research

In sum, this research aimed to examine the interaction between self-esteem and self-efficacy on left-behind children's loneliness and, more specifically, to compare the distinction between general self-efficacy and academic self-efficacy in their potential moderation of the self-esteem's influence on loneliness. To offer insights into causal interpretation and changes over time, we assessed loneliness in a relatively large group of left-behind children over a one-year period and examined the influence of baseline self-esteem, general and academic self-efficacy, and their interactions on loneliness (i.e., both at baseline and change over time). We anticipated that self-esteem would predict lower loneliness at baseline and greater reduction (or less increase) in loneliness over time only when self-efficacy (especially academic self-efficacy) was high, not low.

Methods

Participants

405 left-behind children (M_{age} = 10.510, SD = 1.361; 49.6% girls) from twelve different classes (i.e., from the 4-6th year grade) in three special education schools in rural areas in southwest China participated in the study. These special education schools were established purposefully for left-behind children in their local regions (i.e., all children attending the schools were in a 'left-behind' status). According to a priori power analysis using G*Power [51], we require a minimum of 395 participants to achieve 0.800 power (i.e., 1-β) in detecting a small regressive coefficient (i.e., Cohen's f^2 = 0.020; either for main or interaction effect) at 0.050 alpha level. This sample, therefore, fulfilled this requirement.

Measures

Loneliness

We implemented the Chinese version of Asher et al.'s [52] *Child Loneliness Scale* (CLS-C) at baseline (Time 1) and a one-year follow-up (Time 2). The CLS-C had been validated and used successfully in previous research examining loneliness in Chinese left-behind children [53, 54]. Identical to Asher et al.'s original scale, the CLS-C consists of sixteen self-statements (e.g., "I have nobody to talk to", "It's hard for me to make friends") rated on a 5-point Likert scale from 1 (*not at all true*) to 5 (*always*

true). We retained the eight 'filter' items (e.g., "I like reading") from the original CLS to alleviate potential tension or distress the participating children might experience when responding to those loneliness items. We generated mean scores excluding the 'filter' items for further analysis, with higher scores indicating greater loneliness. Cronbach's alpha of the CLS-C in the current study was 0.710 at both the baseline and the follow-up. Goodness of fit for a one-factor structure of the CLS-C reached to a satisfactory level at both time points (Time 1: x^2 = 139.979, df = 102, p = .008; CFI = 0.936, RMSEA = 0.030, SRMR = 0.043; Time 2: x^2 = 134.537, df = 102, p = .017; CFI = 0.930, RMSEA = 0.028, SRMR = 0.043).

Self-esteem

We assessed participating children's self-esteem at baseline (Time 1), using the Chinese version of *Self-Esteem Scale* (RSES-C) [16]. As Rosenberg's original self-esteem scale [44], the RSES-C consists of ten self-evaluative items (e.g., "I feel that I am a person of worth, at least on an equal plane with others", "I am able to do things as well as most other people") rated on a 4-point Likert scale ranging from 1 (*strongly agree*) to 4 (*strongly disagree*). In line with the literature recommendation [55], we calculated the mean score with an adjustment to the raw score so that higher scores reflect higher self-esteem. Cronbach's alpha of the RSES-C in the current study reached 0.832, reflecting very good internal consistency of the measure. Goodness of fit for a one-factor structure of the RSES-C reached to a good level (x^2 = 67.017, df = 34, p = .001; CFI = 0.966, RMSEA = 0.049, SRMR = 0.041).

General self-efficacy

We employed the Chinese version of Schwarzer and Jerusalem's [49] *General Self-Efficacy Scale* (GSES-C) to examine participating children's general self-efficacy at baseline (Time 1). The GSES-C was used successfully in previous research [53] and has been validated in a large sample of schoolchildren in China [56]. As the original GSES, the GSES-C consists of ten self-report items (e.g., "I can always manage to solve difficult problems if I try hard enough", "I am confident that I could deal efficiently with unexpected events") rated on a 4-point Likert scale from 1 (*not at all true*) to 4 (*exactly true*). We aggregated all items to mean score for further analysis. Cronbach's alpha of the GSES-C in the current study was 0.901, reflecting excellent internal consistency of the measure. Goodness of fit for a one-factor structure of the GSES-C reached to a good level (x^2 = 118.992, df = 34, p < .001; CFI = 0.954, RMSEA = 0.079, SRMR = 0.041).

Academic self-efficacy

We used the Chinese version of Jinks and Morgan's [57] *Morgan-Jinks Student Efficacy Scale* (MJSES-C) [16] to assess participating children's perceived academic self-efficacy at baseline (Time 1). Identical to its original scale, the MJSES-C consists of 30 items about schoolchildren's perception of their talent (e.g., "It is not hard for me to get good grades in school"), academic environment/context (e.g., "I go to a good school "), and effort (e.g., "I always get good grades when I try hard"). All items were rated on a 4-point Likert scale from 1 (*really agree*) to 4 (*really disagree*). Following guidance [57], we generated mean scores for all the items, with higher scores indicating greater academic self-efficacy. Cronbach's alpha of the MJSES-C in the current study was 0.784, reflecting good internal consistency of the measure. Goodness of fit for a one-factor structure of the MJSES-C reached to a very good level (x^2 = 434.318, df = 401, p = .012; CFI = 0.976, RMSEA = 0.014, SRMR = 0.043).

Procedures

With ethics approval from the lead author's institution, we reached out to contact the three participating schools for headmasters' approval, with full study information provided. A decision was then made between the headmaster of the participating school and a team of form teachers regarding which classes were suitable for data collection. Once informed of the decision, we booked mutually agreed times for one research assistant to visit a participating school and give a briefing (i.e., about 15 min) to students of the participating classes and their corresponding form teacher, followed by a Q&A session. The briefing was repeated for each participating class at a participating school, and therefore, the number of visits to a participating school varied depending on the number of participating classes at the certain school. In the briefing session, students received a full pack of paper-based study materials, including a study information sheet, a parental/guardian consent form, a participant consent form, a set of anonymised survey packs consisting of the study measures, and a debriefing statements sheet (i.e., 'thank you' message, help-seeking resources/contacts). These students were given a week time to seek consent, complete the questionnaires, and return the completed survey pack to their form teacher, should they wish to do so. Any unreturned survey pack (i.e., 81 out of the original 485 survey pack sent, thus a sample of 405 participants included in the analysis) after one week was considered withdrawn or rejected to participate. The corresponding research assistant would then collect all completed survey packs from the form teachers. These procedures were identical at all participating schools and for the one-year follow-up time.

Data analysis

For preliminary analysis, we checked for missing data and generated descriptive statistics and correlations for

all study variables in SPSS Version 28. The preliminary results were used to inform further analysis (e.g., controlling for any demographic variable that correlated significantly to primary study variables).

For the main analysis, we used Mplus Version 8 [58] and performed a clustered path model to examine participants' self-esteem, general and academic self-efficacy, and their interactions at baseline in predicting loneliness at baseline and its change over one-year time (see Fig. 1 for the test path model). More specifically, in the tested model, we regressed loneliness at a one-year follow-up on that from the baseline via specifying an autoregressive path between the two. We further regressed loneliness at baseline and at follow-up (i.e., the outcomes) on baseline self-esteem, general and academic self-efficacy, and their interactions (i.e., the predictors), which enabled the test of the predictors's synchronous effects on the study outcome at baseline and simultaneously the examination of the predictors' lagged effects on the study outcome at one-year follow-up. The autoregressive path on study outcome between two time points enabled the test of lagged effects on residualised change in loneliness (i.e., the extent to which an individual deviated from the anticipated loneliness at one-year follow-up given their loneliness at baseline and the general change pattern of the entire cohort over the study period). Such an approach is desired for modelling change over time in a within-person design because it estimates one's relative (i.e., based on one's baseline and change compared to the entire cohort), not absolute (i.e., the observed mean difference across two or more time points) change, and thus less biased and more robust to potential confounding effects when assessing change over time [59].

To account for the nested nature of data (i.e., students nested in classes), we employed a clustered analysis using the TYPE = COMPLEX command function in Mplus to allow regression intercepts to vary across participants from different classes, thus controlling for potential confound and error dependency due to the class membership [60]. We used the Robust maximum likelihood estimator (i.e., MLR in Mplus) for more accurate parameter estimation and to mitigate the potential influence of data non-normality. The MLR estimator in Mplus also enables the Full Information Maximum Likelihood approach [61] and is robust in dealing with missing data when performing path analysis [62]. Since the path model we tested was a saturated model (i.e., no degree of freedom), the goodness of model fit assessments [63] were not applicable and thus neither reported. We report the standardised beta coefficient of the regressive path (β), p value, and 95% confidence interval (CI) of regression coefficients for the path model we tested, with significant interactions

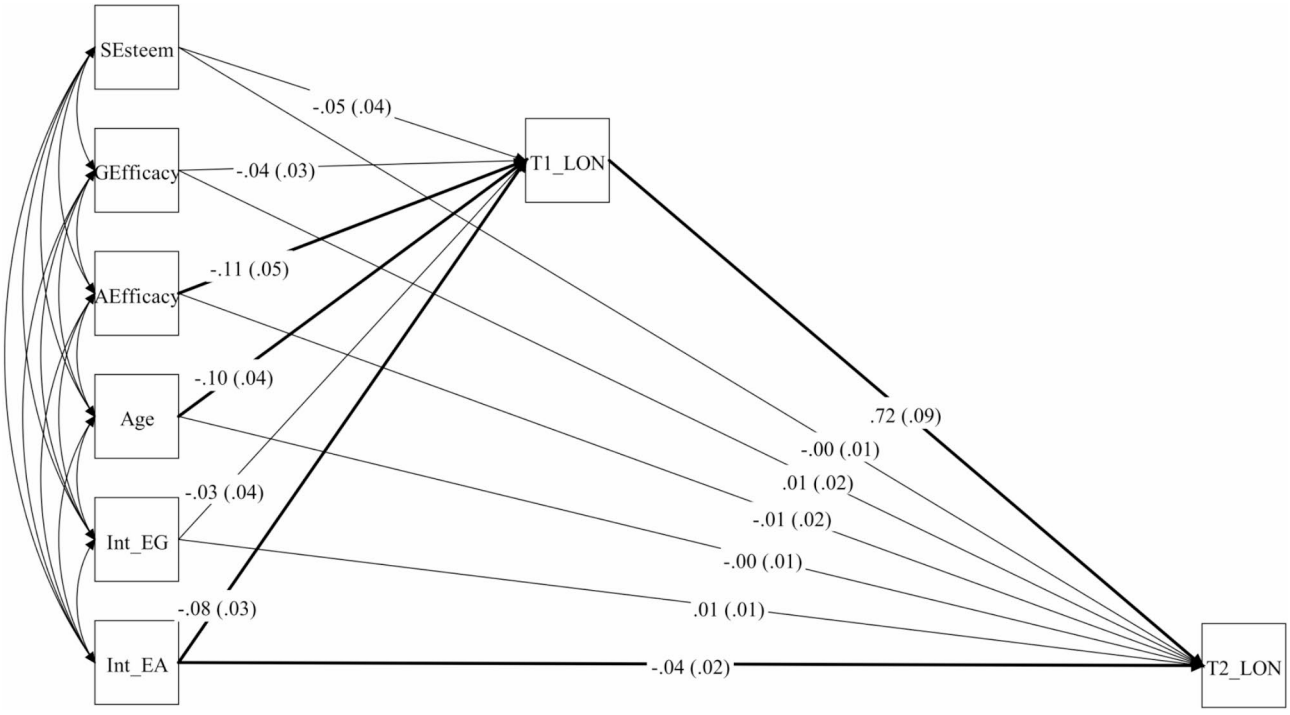

Fig. 1 Illustration of the conceptual path model tested in the study. Each arrowed line represents a hypothesised regressive path. Each bi-directional curve line represents a statistical control of inter-correlation of two predicator variables. Class membership was controlled as cluster (i.e., random intercept enabled across classes). Standardised coefficient and standard error (in parenthesis) of each regressive path was presented, with the paths reached a significance effect bolded in display. *SEsteem* = self-esteem; *GEfficacy* = general self-efficacy, *AEfficacy* = academic self-efficacy, *Int_EG* = interaction between self-esteem and general self-efficacy; *Int_EA* = interaction between self-esteem and academic self-efficacy

Table 1 Descriptive statistics and zero-order correlations of study variables ($n = 405$)

	M	SD	Range	1	2	3	4	5	6
1. Age	10.51	1.36	9–13	–					
2. Self-Esteem (T1)	2.88	0.49	1–4	0.32**	(0.83)				
3. General Self-Efficacy (T1)	2.52	0.58	1–4	0.28**	0.19**	(0.90)			
4. Academic Self-Efficacy (T1)	3.02	0.32	1–4	0.12*	0.12*	0.18**	(0.78)		
5. Loneliness (T1)	2.20	0.50	1–5	−0.39**	−0.22*	−0.25**	−0.33**	(0.71)	
6. Loneliness (T2)	2.09	0.48	1–5	−0.31**	−0.17*	−0.18**	−0.28**	0.77**	(0.71)

Note. T1 and T2 refers to Time 1 (baseline) and Time 2 (follow-up after one year); M = mean score; SD = standard deviation; Cronbach's alpha coefficients are presented on the diagonal. Fornell-Larcker criterion for T1 self-esteem, T1 general self-efficacy, T1 academic self-efficacy, and loneliness at T1 and T2 yielded, 0.67, 0.67, 0.66, 0.58, 0.53, respectively, suggesting good discriminant validity of the study measures (i.e., greater than each pair of the correlations involving the study variable except between T1 and T2 loneliness as it is no point to do so). The largest Heterotrait-monotrait (HTMT) criterion yielded among each pair of study variables was 0.10 (between self-esteem and T2 loneliness), far below the recommended 0.85 threshold suggesting good discriminant validity of study measures

* $p < .05$; ** $p < .01$

Table 2 Regression statistics for clustered path analysis of the self-esteem, general and academic self-efficacy, and their interactions on baseline loneliness and change in loneliness over time ($n = 405$)

	Baseline Loneliness				Residual Change in Loneliness			
	β	SE	*p*	95% CI	β	SE	*p*	95% CI
Self-Esteem (SE)	−0.05	0.04	0.29	[-0.14, 0.04]	−0.00	0.02	0.76	[-0.02, 0.01]
General Self-Efficacy (GSE)	−0.04	0.03	0.20	[-0.10, 0.02]	0.01	0.02	0.65	[-0.03, 0.05]
Academic Self-Efficacy (ASE)	−0.11	0.05	0.03	[-0.21, −0.01]	−0.01	0.02	0.63	[-0.04, 0.03]
SE × GSE	−0.03	0.04	0.38	[-0.11, 0.04]	0.01	0.02	0.27	[-0.01, 0.03]
SE × ASE	−0.08	0.03	0.01	[-0.14, −0.02]	0.04	0.02	0.04	[-0.08, −0.01]
Age	−0.10	0.04	0.01	[-0.18, −0.02]	−0.00	0.01	0.67	[0.55, 0.89]

Note. All predictor variables were assessed at baseline; residual change in loneliness was modelled regressing loneliness at one-year follow-up on baseline loneliness, which was incorporated and tested in the hypothesised path model; children's class membership was controlled as cluster (i.e., random intercept enabled across classes) to account for the nested nature of the data and mitigate potential error dependency due to unobserved confounders related to class membership. *β* = standardised regression coefficient, *SE* = standard error, *CI* = confidence interval. *SE* × *GSE* = interaction between self-esteem and general self-efficacy; *SE* × *ASE* = interaction between self-esteem and academic self-efficacy. For parsimony and consistency, all estimates were carried for two decimal places (e.g., −0.004 was presented as −0.00, whilst 0.006 was reported as 0.01)

($p < .05$) probed via simple slopes analysis at high (+1SD) and low (-1SD) levels of the moderator.

Results

Preliminary analysis

We did not find any missing or outliers (i.e., all data points were within the range of ±2SD from the mean of a certain study variable. Skewness and kurtosis of all study variables were within the range of ±0.714 and ±1.353, respectively, thus suitable for further model testing [64]. Cronbach's alpha of study measures yielded 0.710–784 for loneliness and academic self-efficacy, 0.832 for self-esteem, and 0.901 for general self-efficacy, indicating good, very good, and excellent internal reliability, respectively [65]. Self-esteem manifested positive correlations with general and academic self-efficacy but negative ones with loneliness at baseline and one-year follow-up, of which all these correlations were small to medium in size. General and academic self-efficacy both manifested negative correlations with loneliness at the two study time points, with general self-effiacy's effect size being small-to-medium whilst academic self-efficacy's effect size being medium-to-large. Age was correlated significantly with loneliness at both time points ($r = -.391$ and −0.313 for Time 1 and 2, respecitively, both $Ps < 0.001$). Compared to girls, boys reported slightly greater loneliness at Time 1 (Mean $_{Difference}$ = 0.037, SD = 0.050) and slightly lower loneliness at Time 2 (Mean $_{Difference} = -0.019$, SD = 0.048), but such differences were not statistically significant; for comparison at Time 1: $t(403) = 0.741$, $p = .459$; for comparison at Time 2: $t(403) = -0.386$, $p = .699$. Therefore, we included age not gender as a covariate in the main analysis. We present all details of descriptive statistics and correlations of study variables in Table 1 for interested readers.

Main analysis

The clustered path model (see Fig. 1) accounted for 28.221% variance in participating children's loneliness ($p = .022$) and 60.5% variance in the change of loneliness over the one-year study period ($p = .001$). We presented standardised regression coefficient and the corresponding standard error for each path in Fig. 1 and full details of regression statistics in Table 2. We further report the key analysis results below.

Specifically, once controlled for participating children's class membership as the cluster, neither self-esteem ($\beta = -0.051$, $p = .291$; 95% CI [-142, 0.040]), general self-efficacy ($\beta = -0.040$, $p = .203$; 95% CI [-0.102, 0.021]), nor the self-esteem × general self-efficacy interaction (β =

– 0.034, p =.382; 95% CI [-0.111, 0.043]) predicted loneliness at baseline. Being older (β = – 0.102, p =.011; 95% CI [-0.181, – 0.023]) and higher in academic self-efficacy (β = – 0.112, p =.032; 95% CI [-0.212, – 0.012]) was associated with lowered loneliness. Importantly, the self-esteem × academic self-efficacy interaction (β = – 0.084, p =.013; 95% CI [-0.144, – 0.024]) significantly explained participating children's loneliness at baseline. To unfold this interaction, slope analysis suggested that self-esteem was related to reduced loneliness at baseline only when academic self-efficacy was high (β = – 0.132, p =.050; 95% CI [-0.264, – 0.000]) but not low (β = 0.041, p =.293; 95% CI [-0.032, 0.114]). Figure 2 (top) illustrates the nature of this interaction.

However, when examining the change of loneliness over time (i.e., residual change in accounting for one's relative position at baseline), none of age, self-esteem, general self-efficacy, academic self-efficacy, or the self-esteem × general self-efficacy interaction predicted the change (all Ps > 0.05; see Table 2 for statistical details). Nevertheless, the self-esteem × academic self-efficacy interaction (β = 0.042, p =.041; 95% CI [-0.081, – 0.013]) remained significant. Slope analysis indicated that an increase in self-esteem contributed to a greater reduction in loneliness over one year when academic self-efficacy was high (β = – 0.041, p =.122; 95% CI [-0.092, 0.010]) but less reduction in loneliness when academic self-efficacy was low (β = 0.039, p =.143; 95% CI [-0.006, 0.084]). Figure 2 (bottom) illustrates the nature of this interaction.

Discussion

In the present research, we examined a novel proposition that self-esteem and self-efficacy interactively contribute to loneliness in left-behind children, with an even more specific hypothesis that the amplifying effect of academic self-efficacy on self-esteem's protection on loneliness is greater than that of general self-efficacy. In a sample of 405 left-behind children studying in 4-6th grade, we provided the first evidence that left-behind children's self-esteem predicted lowered loneliness at baseline and greater reduction in loneliness over a one-year period when academic self-efficacy was high compared to not. However, general self-efficacy did not manifest such a moderation effect.

Our findings lead to several noteworthy points. First, self-esteem was consistently associated with lower levels of loneliness at baseline and at the one-year follow-up time, which was in line with the literature [21, 39, 40]. However, after controlling for general and academic self-efficacy and demographic differences and adjusting for participating children's class membership, self-esteem was no longer a significant predictor of baseline loneliness and its change over time. The finding, therefore, supports the view that self-esteem does not manifest identical protection against loneliness at all times because one's self-esteem is relatively stable (e.g., an individual high in self-esteem at a certain point tends to be high in self-esteem in the following years) [41], but the feeling of loneliness could fluctuate significantly even on a daily basis [42]. Also, the nonsignificant effect of participating children's self-esteem on the change of their loneliness over time suggests that there is a lack of causal effect between high self-esteem and low loneliness, or the protection of self-esteem on loneliness is operated through other mechanistic, underpinning factors, at least in left-behind children. To this end, literature has suggested that reduced levels of anxiety and depression [39], enhanced coping [40], and greater life satisfaction [21] may explain why high self-esteem could contribute to reduced loneliness. However, none of these existing studies on self-esteem and its potential mechanistic factors in loneliness offered insights into a lagged effect, or using a longitudinal design to aid causal interpretation and to properly test direct and indirect effects of self-esteem on loneliness. Future research should consider adopting a longitudinal design or examining alternative theory-informed mechanistic factors, such as psychological resilience, to understand how self-esteem protects against loneliness.

Second, academic self-efficacy appeared to be more prominent than general self-efficacy and self-esteem in mitigating loneliness in left-behind children. We demonstrated the first evidence that self-esteem's protection on loneliness (both at baseline and change over time) can be amplified as a function of increased academic (not general) self-efficacy, at least in left-behind children. This finding suggests that future policy and intervention efforts in addressing loneliness-related issues in left-behind children should consider integrating school-level strategies to promote academic self-efficacy. Such a direction (i.e., improving children's academic self-efficacy) is practical in school settings and within the early education system and thus should be well considered by policymakers in education domain and the relevant practitioners (e.g., teachers) [50]. However, compared to the more widely implemented self-efficacy interventions and programmes for health promotion [32], knowledge on best practices for enhancing academic self-efficacy is relatively scarce. Nevertheless, one would expect that Bandura's principal sources of cultivating self-efficacy (e.g., matery experience, vicarious experience, social and verbal persuasion, physical and emotional states) are applicable in the context of acedamic self-efficacy. Given the fact that left-behind children is more prevalent in economically deprived regions (e.g., rural and remote area, developing or underdeveloped countries, etc.) [17], perceived ability in achieving greater academic performance (i.e., academic self-efficacy) leads to greater sense of a opportimistic future in left-behind

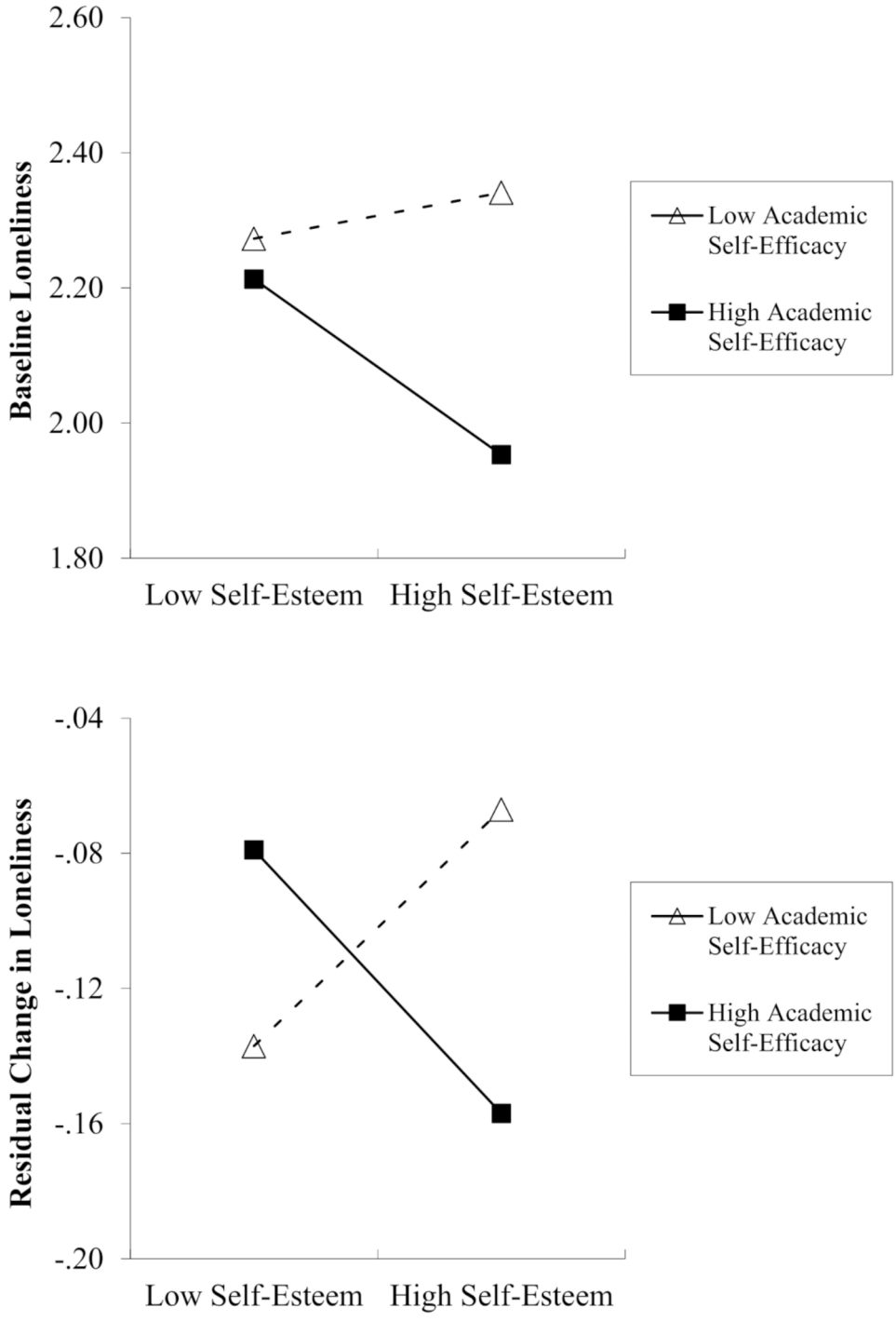

Fig. 2 The nature of self-esteem × academic self-efficacy interaction on baseline loneliness (top) and change of loneliness over one-year time (bottom). Loneliness scores and its residual change over time were understandardised thus should be interpreted alongside the continuum of its measurement scale (range from 1 to 5). Regression slopes are derived from hypothetical individuals who are one standard deviation below the mean (low) and one standard deviation above the mean (high)

children. Interventions working on improving academic self-efficacy in left-behind children, therefore, would do well to tackle cultural and socioeconomical factors that underpins the establishment of academic self-efficacy. Future research is called for understanding more practical aspects of cultivating academic self-efficacy in left-behind children.

Relevant to the aforementioned point, it is possible that a conflictive state of high self-esteem and low academic self-efficacy in left-behind children is particularly

problematic and can lead to inflated loneliness. This is because our data demonstrated that participating children with a combination of high self-esteem and low academic self-efficacy appeared to be the highest at baseline loneliness and the least reduction in loneliness over one year (see Fig. 2) compared to their counterparts. The inflated risk of experiencing loneliness in children with high self-esteem and low academic self-efficacy may be explained by their self-discrepancy [66]. That is, given their high self-esteem, individuals would expect themselves to perform highly in school and deal well with various academic-related challenges; however, when facing a reality of incapability and suffering a feeling of inadequency (e.g., low academic self-efficacy), such a discrepancy may lead to varied issues such as inflated loneliness, especially for left-behind children. As such, schools and practitioners in education settings should consider assessing and/or monitoring children's self-esteem and academic self-efficacy simultaneously when appropriate so as to tackle the potential risk profile (i.e., high in self-esteem but low in academic self-efficacy). Future research would do well to examine the negative impacts of such a discrepancy for a fuller picture and in wider populations.

Last but not least, despite considerable gender invariance in levels of loneliness among the participating left-behind children in the current study sample, potential gender inequality may exist in the context of loneliness. Specifically, our data suggested that left-behind girls compared to boys, in general, reported higher levels of overall academic self-efficacy. Recent meta-analysis further provided a general picture in schoolchildren, that school boys tend to report higher mathematic- and science-related academic self-efficacy, whilst school girls tend to report higher language- and art-related academic self-efficacy [67]. It is still unknown if findings on the subject-specific domains of academic self-efficacy demonstrated in general school settings (70) are applicable to left-behind children; or if different domains of subject-specific academic self-efficacy manifest different moderation on the self-esteem and loneliness relationship. Future research should explore potential gender differences in academic self-efficacy and loneliness and potentially wider aspects of mental health to inform gender-specific strategies in school and education settings.

Limitations and other future directions

Despite evidence-based conceptualisation and robust testing (i.e., cluster path analysis involving loneliness at two time points), the current study is not without limitations. One major limitation is the lack of repeated measures for predictor variables, especially general and academic self-efficacy, given their state nature. In reality, we had considered and originally planned for measuring the two specific forms of self-efficacy both at baseline and one-year follow-up. However, having considered feedback from form teachers of participating schools at baseline regarding the possibility of reducing the number of items in the study questionnaire, we decided to only implement the loneliness measure at the one-year follow-up to get the best chance of retaining as many participants as possible from baseline. Such a decision was made because we had to rely heavily on form teachers as 'gatekeepers' for data collection whilst achieving the required sample size at both baseline and follow-up, which is vital to our planned statistical testing. Future research should consider further investigating how change in general and academic self-efficacy may influence the trajectory of change in loneliness over time.

One potential measurement limitation is the use of the Chinese version Self-Esteem Scale (RSES-C) which was adopted from an existing study in left-behind children [16]. Despite the successful implementation of the RSES-C in children, we acknowledge that this Chinese version scale has yet to be assessed extensively for its psychometric validity and reliability. However, based on the report of internal consistency of RSES-C in existing studies and the current research, one would expect reasonable validity and reliability when assessing self-esteem in Chinese children with an average age of 10 and above. Future research should consider examining the psychometrics properties of the RSES-C in children to a fuller extent.

Another potential limitation is related to the use of Jink and Morgan's scale for assessing children's perceived academic self-efficacy. Indeed, alternative measures exist; for example, some studies [68, 69] utilised self-regulatory learning based self-efficacy as an indicator of one's academic self-efficacy [70, 71]. Compared to the length (e.g., 50 items in Toering et al.'s self-regulation of learning scale) and the performance focus of self-regulatory learning based conceptualisation [72, 73], Jink and Morgan's inventory is probably more suitable for this study because it was designed for schoolchildren (rather adolescents, high school or university students), has been consistently used in relating to self-esteem [37], and had been used successfully in Chinese context with left-behind children [16]. However, we acknowledge that the length of Jink and Morgan's scale (i.e., 30 items) is still quite demanding for schoolchildren. Future research should consider validating a short version for Jink and Morgan's scale thus more practical in research and applied work.

Conclusion

In the present research, we demonstrated a novel finding that high self-esteem's protection against loneliness in left-behind children is dependent on the levels of academic self-efficacy in these children. Specifically, self-esteem predicted lower loneliness at baseline and greater reduction in loneliness over a one-year period among a

sample of 405 left-behind children, only when their academic self-efficacy was high but not low. Meanwhile, a profile of high self-esteem and low academic self-efficacy seemed to be the most at-risk in the context of loneliness. Researchers would do well to further investigate the negative impacts of self-esteem-self-efficacy discrepancy, especially in vulnerable groups (e.g., left-behind children). Future policy and intervention efforts to address loneliness in left-behind children should consider strategies for promoting and enhancing academic self-efficacy in school settings.

Abbreviations

CLS-C	Child loneliness scale– chinese
RSES-C	Rosenberg self-esteem scale– chinese
GSES-C	General self-efficacy scale– chinese
MJSES-C	Morgan-Jinks student efficacy scale– chinese
MLR	Robust maximum likelihood
CFI	Comparative fit index
RMSEA	Root mean square error of approximation
SRMR	Standardised root mean square residual
x^2	Chi-square statistics
df	Degree of freedom
β	Standardised regression coefficient
SE	Standard error
CI	Confidence interval
SE × GSE	Interaction between self-esteem and general self-efficacy
SE × ASE	Interaction between self-esteem and academic self-efficacy

Acknowledgements
The authors wanted to thank Zhenqian Zhou to support and facilitate the data collection for the present research.

Author contributions
YZ and SZ conceptualised and designed the research. YZ and CF led the data collection. SZ and YZ performed the data analysis. YZ, CF, and SZ wrote the main manuscript. SZ reviewed and revised the manuscript.

Funding
No funding was obtained for conducting this study.

Data availability
The data that support the findings of the research are not publicly available due to ethics restriction. The materials, data, and codes for analysis are available for qualified researchers on request from the corresponding authors.

Declarations

Ethics approval and consent to participate
The Hunan University of Technology ethics committee reviewed the study proposal and provided the ethical approval (Reference No. 202205119088) for conducting this research and collecting data in regional schools in the Hunan area. A parental/guardian consent form together with a participant consent form were completed before a participant was allowed to partaking the study (see more details under the Procedures section). These consents obtained from all of the study participants was informed and completed on a voluntary basis. American Psychological Association's (APA) ethics codes were followed closely for conducting the present research.

Consent for publication
Consent for publication is not required as all data reported in the present study were anonymised, and no identifiable data were collected or stored for analytical or reporting purposes. At the consent stage, both the participants and one of their parents/guardian were informed the intention to publish the findings from the anonynised data they provided when partaking in this study. And they had the free right to reject or withdraw from partaking in the study without any consequence.

Competing interests
The authors declare no competing interests.

Received: 25 April 2024 / Accepted: 21 March 2025
Published online: 02 April 2025

References

1. Roberts T, Krueger J. Loneliness and the emotional experience of absence. South J Philos. 2021;59:185–204.
2. Hemberg J, Östman L, Korzhina Y, Groundstroem H, Nyström L, Nyman-Kurkiala P. Loneliness as experienced by adolescents and young adults: an explorative qualitative study. Int J Adolesc Youth. 2022;27:362–84.
3. Sorkin D, Rook KS, Lu JL. Loneliness, lack of emotional support, lack of companionship, and the likelihood of having a heart condition in an elderly sample. 2002
4. Kristensen K, König HH, Hajek A. (2021) The empty nest, depressive symptoms and loneliness of older parents: prospective findings from the German ageing survey. Arch Gerontol Geriatr.
5. Lindgren BM, Sundbaum J, Eriksson M, Graneheim UH. Looking at the world through a frosted window: experiences of loneliness among persons with mental ill-health. J Psychiatr Ment Health Nurs. 2014;21:114–20.
6. Christiansen J, Qualter P, Friis K, Pedersen SS, Lund R, Andersen CM, Bekker-Jeppesen M, Lasgaard M. Associations of loneliness and social isolation with physical and mental health among adolescents and young adults. Perspect Public Health. 2021;141:226–36.
7. Owczarek M, Nolan E, Shevlin M, et al. How is loneliness related to anxiety and depression: A population-based network analysis in the early lockdown period. Int J Psychol. 2022;57:585–96.
8. Heu LC, van Zomeren M, Hansen N. Far away from home and (not) Lonely: relational mobility in migrants' heritage culture as a potential protection from loneliness. Int J Intercultural Relations. 2020;77:140–50.
9. Fried EI, Bockting C, Arjadi R, Borsboom D, Amshoff M, Cramer AOJ, Epskamp S, Tuerlinckx F, Carr D, Stroebe M. From loss to loneliness: the relationship between bereavement and depressive symptoms. J Abnorm Psychol. 2015;124:256–65.
10. Golaszewski NM, Lacroix AZ, Godino JG, et al. Evaluation of social isolation, loneliness, and cardiovascular disease among older women in the US. JAMA Netw Open. 2022.
11. Lederman Z. Loneliness—a clinical primer. Br Med Bull. 2023;145:132–40.
12. Pai N, Vella S-L. The physical and mental health consequences of social isolation and loneliness in the context of COVID-19. Curr Opin Psychiatry. 2022;35.
13. Pedroso-Chaparro M, del Cabrera S, Vara-García I, Márquez-González C, Losada-Baltar M A. Physical limitations and loneliness: the role of guilt related to self-perception as a burden. J Am Geriatr Soc. 2023;71:903–8.
14. Chai X, Du H, Li X, Su S, Lin D. What really matters for loneliness among Left-Behind children in rural China: A Meta-Analytic review. Front Psychol. 2019.
15. Xiong Y, Li X, Li H, Qu C, Liu M, Lu C, Dong W. A meta-analysis of loneliness among left-behind children in China. Curr Psychol. 2023.
16. Zhou Z, Zhou Y, Ferraro FV, Hooton A, Ribchester C. The effects of Latino dance intervention on academic and general self-efficacy with left-behind children: an experimental study in China. Front Psychol. 2023.
17. Xiao J, Liu X. How does family cultural capital influence the individuals' development? —case study about left-behind children in China. Asia Pac Educ Rev. 2023;24:167–78.
18. Shi H, Wang Y, Li M, et al. Impact of parent-child separation on children's social-emotional development: a cross-sectional study of left-behind children in poor rural areas of China. BMC Public Health. 2021.
19. Song J, Ma C, Ruan Y. Left-behind children's grandparent–child and parent–child relationships and loneliness: A multivariable mediation model. Fam Relat. 2021;70:195–206.
20. Wang Q, Wang H, Liu X. Loneliness, non-suicidal self-injury, and friendship quality among Chinese left-behind adolescents: the role of parent-child cohesion. J Affect Disord. 2020;271:193–200.
21. Wang L, Yao J. Life satisfaction and social anxiety among left-behind children in rural China: the mediating role of loneliness. J Community Psychol. 2020;48:258–66.
22. Li K, Ren L, Zhang L, Liu C, Zhao M, Zhan X, Li L, Luo X, Feng Z. Social anxiety and depression symptoms in Chinese left-behind children after the lifting of COVID-19 lockdown: A network analysis. Int J Soc Psychiatry. 2022;69:916–27.

23. Leskauskas D, Adomaitienė V, Šeškevičienė G, Čėsnaitė E, Šmigelskas K. Self-reported emotional and behavioral problems of left-behind children in Lithuania. Child Indic Res. 2020;13:1203–16.
24. Zhao G, Wang M, Xu J, Lu J, Akezhuoli H, Wang F. Health status and association with interpersonal relationships among Chinese children from urban migrant to rural left-behind. Front Public Health. 2022.
25. Thapa DK, Visentin D, Kornhaber R, Cleary M. Migration of adult children and mental health of older parents left behind: an integrative review. PLoS ONE. 2018.
26. Qiu Y, Dou H, Dai Y, Li H, Lei Y. The influence of being left behind on fear acquisition and academic performance—a study of left-behind children. Curr Psychol. 2023;42:28095–106.
27. Guan S, Deng G. Whole-community intervention for left-behind children in rural China. Child Youth Serv Rev. 2019;101:1–11.
28. Hung J. Policy-oriented examination of left-behind children's health and well-being in China. Sustain (Switzerland). 2023.
29. Pyszczynski T, Greenberg J, Solomon S, Arndt J, Schimel J. Why do people need Self-Esteem? A theoretical and empirical review. Psychol Bull. 2004;130:435–68.
30. Leary MR, MacDonald G. Individual differences in self-esteem: A review and theoretical integration. Handbook of self and identity. New York, NY, US: The Guilford Press; 2003;401–18.
31. Bandura A. Self-efficacy: the exercise of control. New York: Freeman; 1997.
32. Bandura A. Health promotion by social cognitive means. Health Educ Behav. 2004;31:143–64.
33. Orth U, Robins RW. Is high self-esteem beneficial? Revisiting a classic question. Am Psychol. 2022;77:5–17.
34. Sevelko K, Bischof G, Bischof A, Besser B, John U, Meyer C, Rumpf HJ. The role of self-esteem in internet addiction within the context of comorbid mental disorders: findings from a general population-based sample. J Behav Addict. 2018;7:976–84.
35. Wongtongkam N. Influence of coping, self-esteem and social support on undergraduate students' emotional distress. Health Educ. 2019;119:187–201.
36. Noronha L, Monteiro M, Pinto N. A study on the self-esteem and academic performance among the students. Int J Health Sci Pharm (IJHSP) 2018;2.
37. Lohbeck A. Does integration play a role? Academic self-concepts, self-esteem, and self-perceptions of social integration of elementary school children in inclusive and mainstream classes. Soc Psychol Educ. 2020;23:1367–84.
38. Kuo BCH, Huang S, Li X, Lin D. Self-esteem, resilience, social support, and acculturative stress as predictors of loneliness in Chinese internal migrant children: A model-testing longitudinal study. J Psychol. 2021;155:387–405.
39. Dai Q, Chu RX. Anxiety, happiness and self-esteem of Western Chinese left-behind children. Child Abuse Negl. 2018;86:403–13.
40. Cui S, Cheng F, Zhang L, Zhang C, Yuan Q, Huang C, Zhang K, Zhou X. Self-esteem, social support and coping strategies of left-behind children in rural China, and the intermediary role of subjective support:a cross-sectional survey. BMC Psychiatry. 2021.
41. Robins RW, Trzesniewski KH. Self-esteem development across the life span. Curr Dir Psychol Sci 14. 2005
42. Awad R, Shamay-Tsoory SG, Palgi Y. Fluctuations in loneliness due to changes in frequency of social interactions among older adults: a weekly based diary study. Int Psychogeriatr. 2023;35:293–303.
43. Bandura A. Health promotion from the perspective of social cognitive theory. Psychol Health. 1998;13:623–49.
44. Rosenberg M. Society and the adolescent self-image. NJ: Princeton University Press; 1965.
45. Al Khatib SA. Exploring the relationship among loneliness, self-esteem, self-efficacy and gender in united Arab Emirates college students. Eur J Psychol. 2012;8:159–81.
46. Mikkelsen HT, Haraldstad K, Helseth S, Skarstein S, Småstuen MC, Rohde G. Health-related quality of life is strongly associated with self-efficacy, self-esteem, loneliness, and stress in 14–15-year-old adolescents: a cross-sectional study. Health Qual Life Outcomes. 2020.
47. Flynn DM, Chow P. Self-efficacy, self-worth, and stress. Educ (Chula Vista). 2017;138:83–8.
48. Bandura A. Guide for constructing self-efficacy. In: Pajares F, Urdan TS, editors. Self-efficacy beliefs of adolescents. Age Information Publishing; 2006. pp. 307–37.
49. Schwarzer R, Jerusalem M. Generalized Self-Efficacy scale. In: Weinman S, Wright M, Johnston M, editors. Measures in health psychology: A user's portfolio. Windsor, UK: NFER-NELSON; 1995. pp. 35–7.
50. Schunk DH, Pajares F. (2002) The Development of Academic Self-Efficacy. In: Development of Achievement Motivation. Elsevier, pp 15–31.
51. Faul F, Erdfelder E, Buchner A, Lang AG. Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. Behav Res Methods. 2009;41:1149–60.
52. Asher SR, Hymel S, Renshaw PD. Loneliness in children. Child Dev. 1984;55:1456–64.
53. Chen G, Gully SM, Eden D. General self-efficacy and self-esteem: toward theoretical and empirical distinction between correlated self-evaluations. J Organ Behav. 2004;25:375–95.
54. Jia Z, Tian W. Loneliness of left-behind children: A cross-sectional survey in a sample of rural China. Child Care Health Dev. 2010;36:812–7.
55. Robins RW, Hendin HM, Trzesniewski KH. Measuring global self-esteem: construct validation of a single-item measure and the Rosenberg Self-Esteem scale. Pers Soc Psychol Bull. 2001;27:151–61.
56. Zeng G, Fung S, fu, Li J, Hussain N, Yu P. Evaluating the psychometric properties and factor structure of the general self-efficacy scale in China. Curr Psychol. 2022;41:3970–80.
57. Jinks J, Morgan V. Children's perceived academic self-efficacy: an inventory scale. J Educational Strategies. 1999;72:224–30.
58. Muthén LK, Muthén BO. Mplus user's guide, eighth edition. Los Angeles, CA: Muthén & Muthén; 2017.
59. Castro-Schilo L, Grimm KJ. Using residualized change versus difference scores for longitudinal research. J Soc Pers Relat. 2018;35:32–58.
60. Hayes AF. Introduction to mediation, moderation, and conditional process analysis: A regression based approach. New York, NY: Guilford Press; 2013.
61. Hirose K, Kim S, Kano Y, Imada M, Yoshida M, Matsuo M. Full information maximum likelihood Estimation in factor analysis with a large number of missing values. J Stat Comput Simul. 2015;86:91–104.
62. Newman DA. Missing data: five practical guidelines. Organ Res Methods. 2014;17:372–411.
63. Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct Equ Model. 1999;6:1–55.
64. Kline R. Principles and practice ofstructural equation modeling. 4th ed. New York: Guilford; 2016.
65. Cohen J, Cohen P, West SG, Aiken LS. Applied multiple regression/correlation analysis for the bahvioural sciences. 3rd ed. Hillsdale: Erlbaum; 2003.
66. Higgins ET. Self-discrepancy: A theory relating self and affect. Psychol Rev. 1987;94:319–40.
67. Huang C. Gender differences in academic self-efficacy: A meta-analysis. Eur J Psychol Educ. 2013;28:1–35.
68. Gutiérrez-Braojos C. Future time orientation and learning conceptions: effects on metacognitive strategies, self-efficacy beliefs, study effort and academic achievement. Educ Psychol (Lond). 2015;35:192–212.
69. Baird GL, Scott WD, Dearing E, Hamill SK. Cognitive self-regulation in youth with and without learning disabilities: academic self-efficacy, theories of intelligence, learning vs. performance goal preferences, and effort attributions. J Soc Clin Psychol. 2009;28:881–908.
70. Toering T, Elferink-Gemser MT, Jonker L, van Heuvelen MJG, Visscher C. Measuring self-regulation in a learning context: reliability and validity of the Self-Regulation of learning Self-Report scale (SRL-SRS). Int J Sport Exerc Psychol. 2012;10:24–38.
71. Zimmerman BJ. A social cognitive view of self-regulated academic learning. J Educational Psychoilogy. 1989;81:329–39.
72. Zimmerman BJ. Investigating self-regulation and motivation: historical background, methodological developments, and future prospects. Am Educ Res J. 2008;45:166–83.
73. Zimmerman BJ. Development and adaptation of expertise: the role of self-regulatory processes and beliefs. In: Ericsson KA, Charness N, Feltovich PJ, Hoffman RR, editors. The Cambridge handbook ofexpertise and expert performance. New York: Cambridge University Press; 2006. pp. 705–22.

Publisher's note