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ORIGINAL ARTICLE

Understanding the Link Between Adverse Childhood Experiences (ACEs) and School Engagement: Investigating the Role of Child Self-concept as a Mediator

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Abstract

This study examines the longitudinal association between a relatively broad Adverse Childhood Experiences (ACEs) index within Growing Up in New Zealand (GUiNZ) measured up to age 8, and low school engagement at age 12. The study also explores the potential mediating role of children's self-esteem and scholastic self-concept in this relationship. Using data from an ethnically diverse longitudinal birth cohort of 3858 children in New Zealand, we investigated how early exposure to adversity influences school engagement at age 12. The findings indicate that childhood adversity (up to age 8) is negatively associated with school engagement at age 12. Moreover, this relationship was partially mediated by self-esteem and scholastic self-concept measured at age 8. The mediating effect was consistent across ethnic groups. The results highlight the need for ACEs prevention strategies, early identification of at-risk children, and trauma-informed school environments. Additionally, system-level support to enhance self-esteem may foster greater school engagement, promoting long-term academic and life success.

Keywords Adverse childhood experiences · Self-concept · School engagement

Introduction

School engagement includes aspects of students' emotional and behavioral involvement (participation, academic learning time), as well as their cognitive connections to school (Fredricks et al., 2004). Engaged learners are, on average, more regularly involved in school and learning activities, have a deeper sense of school connectedness, and have better achievement outcomes (Bempechat & Shernoff, 2012). Moreover, a lack of engagement in school may contribute to lower academic performance and dropping out (Yang et al., 2023). The significant impact that school engagement has on students' academic success (Rumsey & Milsom, 2018), underscores the need for a thorough examination of the risk factors contributing to student disengagement within educational environments.

A range of systemic and institutional factors within the school environment can contribute to student disengagement. Factors such as teacher practices (Thomas & Nair, 2023), social support (Estell & Perdue, 2013; Izar-De-La-Fuente et al., 2023), institutional culture (Kremling & Brown, 2017), and the degree to which schools value students' lives, experiences, cultures, and aspirations (Smyth, 2006) play a significant role in shaping engagement levels. These factors can contribute to students' school engagement in different ways. For instance, institutional racism as a powerful manifestation of institutional culture can lead to underachievement, which in turn contributes to disengagement as a survival strategy (Graham & Robinson, 2004). Disengagement also can be a reaction to an environment that fails to affirm or support students' academic

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potential or provide equitable opportunities for success (Berryman & Eley, 2019; Bowden, 2008).

While systemic factors play a key role in student engagement, the significance of childhood trauma has also garnered attention as an influential factor contributing to challenges with learning, social/emotional health, and behaviors; all of which can negatively impact the school experience and lead to issues with school engagement (Rumsey & Milsom, 2018). Adverse childhood experiences (ACEs) are a specific definition of traumatic experiences that occur during childhood, which have emerged as a key focus in research on child development since the initial CDC-Kaiser ACEs Study (Felitti et al., 1998). ACEs include indicators of child abuse and maltreatment (e.g., child physical, psychological, and sexual abuse), as well as family dysfunctions (e.g., household mental illness, substance abuse, incarceration, parental separation/divorce or death, and intimate partner violence against female caregiver) (Bethell et al., 2014; Felitti et al., 1998).

The reverse association between ACEs and school engagement has been documented in previous studies (e.g., Crouch et al., 2019; McDoniel & Bierman, 2023). While informative, the research in this domain has certain limitations. For instance, many of these studies rely only on reports of childhood adversity at a single point in a child's life (e.g., McDoniel & Bierman, 2023), which is prone to recall biases that could over- or under-estimate prevalence or consequences of ACEs exposure. Measuring ACEs prospectively allows for the possibility of obtaining more accurate assessments of experiences and also supports detailed untangling of the relationship among various adversities, demographics, and behaviors to better explain causal sequencing. Moreover, the list of preventable childhood adversities that have been used in these studies omits a number of key domains, such as exposure to peer-bullying, that have been listed as an adverse childhood experience by the Centers for Disease Control and Prevention (CDC) and World Health Organization (CDC, 2023; WHO, 2022) and have been judged by many developmental researchers as important predictors in immediate health and well-being outcomes (Finkelhor et al., 2013).

The original ACE scales also may overlook societal or structural determinants of ACEs and consider families as the main cause (and solution) to ACEs, which results in the oversight of structural and societal factors such as systematic discrimination/racism (McEwen & Gregerson, 2019), especially in countries like New Zealand (NZ) with histories of colonization. Qualitative and quantitative studies support expanding the concept of childhood adversity to include community-level indicators such as experiencing racism, witnessing community violence, living in an unsafe neighborhood, experiencing bullying, and having a history with foster or institutional care (Cronholm et al., 2015; Pachter et al., 2014; Wade et al., 2014). Research increasingly identifies racial and ethnic discrimination as a risk factor for poor health and a contributor to ethnic health disparities (Stanley et al., 2019), with particular relevance for Māori and ethnic minority populations in NZ given the country's history of colonization. These considerations support the inclusion of ethnicity-based discrimination in ACEs measures used in the NZ context.

Another limitation of most studies examining the relationship between ACEs and school engagement is their reliance on a small number of survey items or questions to measure school engagement, which may not fully capture the multidimensional nature of this construct (e.g., Bethell et al., 2014; Crouch et al., 2019; Webb et al., 2022). A more comprehensive assessment of school engagement could involve incorporating multiple dimensions of engagement, such as behavioral, cognitive, and emotional aspects, which allows for a more nuanced understanding of students' overall engagement with school.

Additionally, a limitation in the literature arises from using regressions to examine the association between ACEs and school engagement, often without accounting for measurement errors. By failing to address measurement error, studies risk underestimating the true impact of ACEs on school engagement and may produce biased estimates of mediating effects. Unlike these traditional regression methods, Structural Equation Modeling (SEM) explicitly addresses measurement error by allowing for the estimation of latent constructs. This feature of SEM enables a more robust analysis by capturing the underlying relationships among ACEs and school engagement while accounting for measurement errors.

Finally, research on the potential pathways linking ACEs to school engagement is also scarce. Among the potential pathways, the collection of beliefs, attitudes, and perceptions that children have about themselves might be a plausible mechanism for elucidating the connection between ACEs and school engagement. These beliefs could be enhanced in a supportive school environment that fosters student choice and creativity, and through children's participation in activities like music, guidance programs, and sports (Coleman, 1961; Degé & Schwarzer, 2017; Mendo-Lázaro et al., 2017; Yusop et al., 2018). Children's beliefs and perceptions about themselves may be global, reflecting an individual's general sense of worth or self-esteem, or specific to a particular domain, such as academic self-concept (attitudes about oneself as a student). Research shows that experiencing traumatic events, exposure to childhood maltreatment and adversity can significantly influence one's perception of themselves, leading to feelings of worthlessness, inadequacy, self-doubt (Chen et al., 2022;

Kim et al., 2022; Melamed et al., 2024; Tripathi & Pandey, 2018; Yan et al., 2024), and reduced feelings of competence (Hughes et al., 2016). The distorted self-concept can, in turn, negatively impact children's attitudes toward school (Green et al., 2012) and their ability to handle academic demands (Basharpoor et al., 2022). Moreover, students' engagement in learning activities, including cognitive and affective engagement, is driven by students' motivational characteristics such as self-concept (Schnitzler et al., 2021) and students who perceive their academic skills positively tend to participate in more attainment-oriented behaviors, such as engaging in class activities, finishing homework, and studying for exams (Valentine et al., 2004). This is in line with expectancy-value theory, which suggests that an individual's positive self-evaluation can predict education-related choices, aspirations, and outcomes (Fang, 2016). Given the considerations outlined, it is reasonable to postulate that ACEs impact school engagement by undermining children's self-esteem and scholastic self-concept. This means that when children experience adversity, they may develop negative self-perceptions, which can ultimately result in lower school engagement.

Despite the high prevalence of ACEs in NZ (Fanslow et al. 2021; Hashemi et al. 2021, 2025b), existing research on ACEs and school engagement has largely relied on cross-sectional designs, limited ACEs measures, and traditional regression approaches that do not account for measurement error. The present study builds on this established literature by providing robust, NZ-specific longitudinal evidence of these relationships, and by employing SEM with latent variables to estimate these pathways with greater precision. Understanding these mechanisms can provide evidence to support interventions that strengthen self-concept as a protective factor, while also informing school policies, educational programs, counseling services, and teachers—key players in fostering students' confidence and academic engagement. Moreover, research highlights the importance of recognizing the influence of cultural context and considering the interplay between ACEs and race/ethnicity in shaping outcomes (Yang et al., 2025). Given NZ's diverse population, testing these pathways across ethnic groups is essential to determine whether the suggested pathway applies to all ethnic groups. It also could allow researchers and policymakers to develop a more nuanced understanding of how ACEs impact school engagement across ethnic groups and foster fairness, cultural appropriateness, and effectiveness in research and interventions.

Current Study

Utilizing data from a large child cohort study in NZ, this prospective study aims to strengthen and contextualize existing evidence by providing longitudinal, NZ-specific estimates of the association between a relatively broad ACEs index in the Growing Up in New Zealand (GUiNZ) cohort and school engagement. Consistent with previous cross-sectional regression-based studies, we hypothesize that there is a longitudinal link between ACEs and school engagement (Hypothesis 1). We also examine whether self-concept (including self-esteem and scholastic self-concept) mediates this association. Based on prior research that shows childhood diversity can negatively impact children's self-concept, which in turn affects school engagement, we hypothesize that self-concept mediates this link (Hypothesis 2). Finally, we test whether this mediating pathway is invariant across different ethnic groups in NZ. This part of the analysis is exploratory and is guided by the recognition that NZ's diverse population and complex cultural landscape may influence these relationships; thus, we do not make a specific hypothesis.

Methods

Participants

Data came from GUiNZ, a contemporary child cohort study, which enrolled 6822 pregnant women with an expected due date between 25 April 2009 and 25 March 2010 and 4401 of their partners, and then the 6853 children born to these women who survived to age 6 weeks (Morton et al., 2015). Cohort profile and recruitment have been described in depth elsewhere (Morton et al., 2020). Compared to children recruited at baseline, children lost to attrition by the eight-year data collection wave (DCW8) and 12-year DCW, are among households living in areas of higher socioeconomic deprivation, or those where mothers identified with a non-European ethnic group, were younger, and reported lower educational attainment (Hashemi et al. 2025a; Napier et al. 2024). Implications of differential attrition and its potential impact are considered in the limitations section. The current study includes 4211 children who participated in the child report DCW8 and DCW12. This study also focuses on participants who resided within NZ during the DCW12, and one child per mother, selected at random, to avoid dependent observations (i.e., 59 children were deleted where mothers gave birth to twins or triplets), which resulted in a sample of 3975 children. The final sample of 3858 children was determined by retaining those with available mediator and outcome data. The study population comprised almost the same percentage of boys and girls. Half of the sample were NZ European (54.1%), and MELAA [Middle East, Latin American,

African] participants represented the smallest ethnic group at 2.1%. Of the sample, 16.6% were identified as food-insecure (Table 1).

Measures

Outcome Variable

Our analysis included the 17 items from the DCW12 of the GUiNZ study, which measures school engagement through behavioral, cognitive, and emotional components (Tait et al. 2023a, b). The items related to behavioral engagement were taken from the Following Class Rules (FCR) subscale of the Class Maps Survey (CMS), developed by Doll et al. to assess students' perceptions of their own behavior in class with appropriate internal consistency (Doll et al., 2010). Minor adaptations were made to the tool for use in the DCW12 to contextualize the language for the NZ context (Tait et al. 2023b). In the current study, the internal consistency of the behavioral engagement component was measured using Cronbach's alpha, yielding a value of $\alpha = 0.91$.

Cognitive engagement describes how learners participate in and monitor their own schoolwork. The Regulating scale of the Goal Orientation and Learning Strategies Survey (GOALS-S) (Dowson & McInerney, 2004) was used to ask young people to reflect on their perceptions of their cognitive engagement in school, such as whether they ask for help, and whether they will try to learn something again later if they are confused. This scale was created for use in an Australian sample and was shown to be valid in that context and invariant across male and female respondents (Dowson and McInerney 2004; Tait et al. 2023b). Cronbach's alpha was used to measure the internal consistency of cognitive engagement in the current study, with a value of 0.83.

Table 1 Sociodemographic characteristics for the whole sample ($n = 3858$)

Sociodemographic variables		Frequency (n)	Percentage (%)
Child's gender ($n = 3858$)	Girl	1900	50.8
	Boy	1958	49.3
Child's prioritized ethnicity ($n = 3824$)	Māori	840	22
	Pacific	338	8.9
	Asian	493	13
	MELAA	84	2.1
	NZ European	2069	54.1
Area level deprivation (NZ DEP 2013) ($n = 3842$)	Least deprived (1–3)	1460	38
	Moderately deprived (4–7)	1504	39.2
	Most deprived (8–10)	878	23
Experienced food insecurity ($n = 3692$)	Yes	612	16.6
	No	3080	83.4

Emotional engagement (also known as school satisfaction) refers to the degree to which students are content with their schooling, and considers their perceptions of the school environment, and asks them to reflect on their interpersonal relationships within this context. The Student Personal Perception of Class Climate Scale (SPPCC) (Rowe et al., 2010) was utilized to ask about students' emotional engagement, such as whether they look forward to going to school and whether school is interesting. The SPPCC is a 6-item scale was developed and validated by Rowe and colleagues for use in a south-eastern state of the United States (Rowe et al., 2010) and has since been validated for use in other contexts, including NZ (Rubie-Davies et al., 2015). Confirmatory factor analysis revealed all six items relating to school satisfaction to load onto one factor, and subscales represented the same conceptual framework for European, Māori, Pasifika, and Asian students (configural invariance) (Rubie-Davies et al., 2015). The current study measured the internal consistency of emotional engagement using Cronbach's alpha, resulting in a value of 0.91.

Items were assigned to behavioral, cognitive, and emotional domains based on their original subscale structure within the validated instruments (CMS, GOALS-S, and SPPCC), consistent with prior applications in the GUiNZ study (Tait et al. 2023a, b). This classification was supported within the measurement component of the SEM model, where all items loaded onto their respective latent factors with standardized loadings ranging from 0.57 to 0.95. These domains reflect an established multidimensional operationalisation of school engagement and capture behavioral, cognitive, and emotional components as measured in the GUiNZ study.

Exposure Variable

Nine ACEs were measured using indicators and instruments of childhood adversities (child report, parent report, standardized questionnaires) in the first 8 DCWs of GUiNZ: ethnic discrimination, parental divorce, emotional abuse, parental incarceration, maternal exposure to intimate partner violence (IPV), physical abuse, parental substance abuse, household mental illness, and peer bullying. All variables' definitions are provided in Supplementary Table 1. We used an ACE score ranging from 0 to 9 as our main exposure variable. More details about the ACEs index can be found somewhere else (Hashemi et al. 2025a).

No data on children's direct experience of ethnic discrimination was collected as part of the GUiNZ study up to and including the 8-year data collection wave. Therefore, mother's exposure to ethnic discrimination based on ethnicity was used as a proxy for the child's exposure to this ACE, which is considered appropriate for the NZ context (Joy &

Beddoe, 2019). The concept of 'linked lives' highlights how parental experiences, such as discrimination, can affect a child's development through intergenerational stress transmission (Kelly et al., 2013). Various experiences of discrimination, particularly during 'sensitive periods', may lead to feelings of helplessness in children and have lasting impacts on their mental and physical health (Heard-Garris et al., 2018). The measure captured ethnicity-based discrimination across multiple institutional domains, including healthcare, employment, housing, the justice system, financial services, and education, as well as experiences of ethnically motivated verbal or physical attack (Supplementary Table 1).

Mediators

In this study, two domains of the Harter scale (global self-worth and scholastic self-concept), assessed at age eight, were used as mediators in the association between ACEs and school engagement. The scale has demonstrated good validity and reliability across child populations, with strong internal consistency and test-retest stability (Harter, 2012; Muris et al., 2003). Global self-concept reflects self-worth or self-esteem, with Cronbach's alpha ranging from 0.78 to 0.87 across eight samples (Harter, 2012), and 0.70 in our sample. Scholastic self-concept evaluates a child's perceived cognitive competence in schoolwork, with reported Cronbach's alpha from 0.80 to 0.84 across eight samples (Harter, 2012) and 0.67 in our sample.

Data was not collected on other subscales of the Harter scale in wave 8 of GUiNZ.

Sociodemographic Characteristics

Child's sex (mother-reported at 9 months) and ethnicity (54 months) were included as demographic characteristics, and food insecurity and area deprivation level were included as socioeconomic measures. Child ethnicity was used to explore the invariance of the mediation model across ethnicity groups in NZ. It was externally prioritized from total response ethnicity collected using the NZ Ministry of Health protocol whereby individuals with more than one broad ethnic grouping are assigned to a single grouping based on the following hierarchy: Māori, Pacific, Asian, MELAA, European/New Zealander/Other (Ministry of Health, 2017). European (n = 2500) and New Zealanders (n = 514) were combined as prior research has found that the majority of those who identify as New Zealanders are European (Cormack & Robson, 2010). Due to the small sample size, 'Other' (n = 5) was also combined with European/New Zealander. For simplicity, we refer to this group as NZ European in this study. The MELAA group (n = 90) was not grouped with European/New Zealander as it represented a bigger portion of the overall sample compared to the 'Other' category ($n = 5$), but it was removed from the multigroup analysis because of its low sample size, which could limit the statistical power of the comparisons.

Food insecurity was derived from mothers' responses at DCW8 to "We can afford to eat properly. How often has this been true for your household over the past year?", binarized to "Always" versus "Sometimes"/"Never". Area deprivation level at DCW8 was derived by the GUiNZ team according to NZDep2013 Index of Deprivation (Atkinson et al., 2013).

Data analysis

Mediating Model

Informed by the literature review, we constructed a hypothesized model (see Fig. 1) in which self-esteem and scholastic self-concept at age 8 mediate the relationship between ACEs and school engagement at 12 years old. The hypothesized model was assessed using SEM because school engagement and self-concept are latent constructs — they cannot be observed directly but are inferred from multiple survey items. Unlike traditional regression, SEM explicitly accounts for measurement error in these items, producing less biased estimates of the relationships between constructs. It also allows for testing direct and indirect pathways simultaneously within a single model. However, SEM does not establish causation from observational data, nor can it compensate for limitations in the measures themselves. R package lavaan was used for conducting analyses (Rosseel, 2012). Given that the 4-point and 5-point Likert scale (employed in school engagement and self-concept tools) yields ordinal data, we designated the item responses as ordered categorical in the model, and thus the models were run using the weighted least square mean and variance adjusted (WLSMV) estimation. Model fit for SEM was determined using widely accepted relative fit indices: the Comparative Fit Index (CFI) ≥ 0.90 and TLI ≥ 0.90, the Root Mean Square Error of Approximation (RMSEA) ≤ 0.08, (Standardized) Root Mean Square Residual (SRMR) < 0.08 (Fan & Sivo, 2007). Sex and area deprivation level were included in the SEM models as covariates.

Analysis of Invariance

We performed a multigroup invariance analysis to examine potential variation in the factor structure across four ethnic groups i.e., Māori, Pacific, Asian, and NZ European/New Zealander/Other. This involved fitting nested Multiple-Group Confirmatory Factor Analysis (MGCFA)

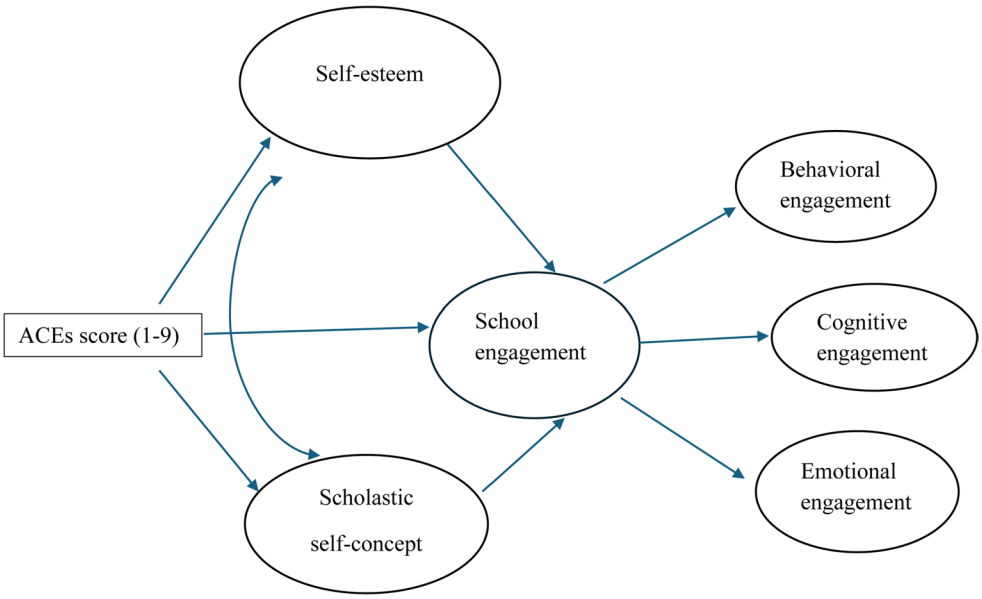

Fig. 1 Mediating model linking ACEs to school engagement (at age 12) through self-esteem and scholastic self-concept (at age 8)

models to the data to access configural invariance (model 1: same factor pattern), metric invariance (model 2: same factor loadings), and scalar invariance (model 3: same loading and intercepts) (Luong & Flake, 2023). Additionally, we examined the differences in relationships among our measures between the groups by constraining regression coefficients across four ethnicity groups (model 4) and comparing it with the unconstrained SEM model where all estimates are free to vary between the groups (model 5). Invariance has traditionally been evaluated using the $\chi 2$ difference test ($\Delta\chi 2$), with a statistically significance decrease in $\chi 2$ for the more constrained model indicative of non-invariance. However, more recently, researchers have advocated for an alternative, given the sensitivity of the $\Delta\chi 2$ to sample size, which can lead to conclusions of non-invariance when the decrease in fit is statistically significant but trivial for practical measurement purposes (Byrne et al., 2007; Cheung & Rensvold, 2002). Thus, for each level of invariance, we compared the difference in fit between the more constrained and less constrained models. If the CFI decreased by more than 0.01 between two nested models and ΔRMSEA > 0.015, the more restrictive model was rejected (Chen, 2007; Cheung & Rensvold, 2002).

Multigroup invariance analysis determines whether the survey items and structural pathways in the proposed model function equivalently across ethnic groups. This is a necessary step when comparing findings across groups, as differences in how constructs such as school engagement and self-concept are interpreted or expressed across cultural contexts could bias cross-group comparisons. Confirming invariance provides assurance that observed associations between ACEs, self-concept, and school engagement reflect consistent underlying processes across groups.

Association Between Individual ACEs, Self-esteem, Scholastic Self-concept, and School Engagement

While not the main objective of the current study, associations between individual ACEs, self-esteem and school engagement were explored and are presented in Supplementary Table 2, as they were deemed useful for understanding the broader context of the findings and their implications. The associations of each ACEs with these outcomes were assessed using SEM models. All models were adjusted for sex, ethnicity, and area deprivation level.

Results

The Mediating Role of Self-concept in the Association Between ACEs and School Engagement

Figure 2 illustrates the model, which includes the direct and indirect effect of ACEs on school engagement at the age of 12 through self-esteem and scholastic self-concept at age 8. The model also includes the factor loadings of items for behavioral (items BE1-BE6), cognitive (items CE1-CE5), and emotional components (items EE1-EE6) of school engagement as well as factor loading for items of self-esteem (items GSC1-GSC5) and scholastic self-concept (items SSC1-SSC5). In this model, all path coefficients

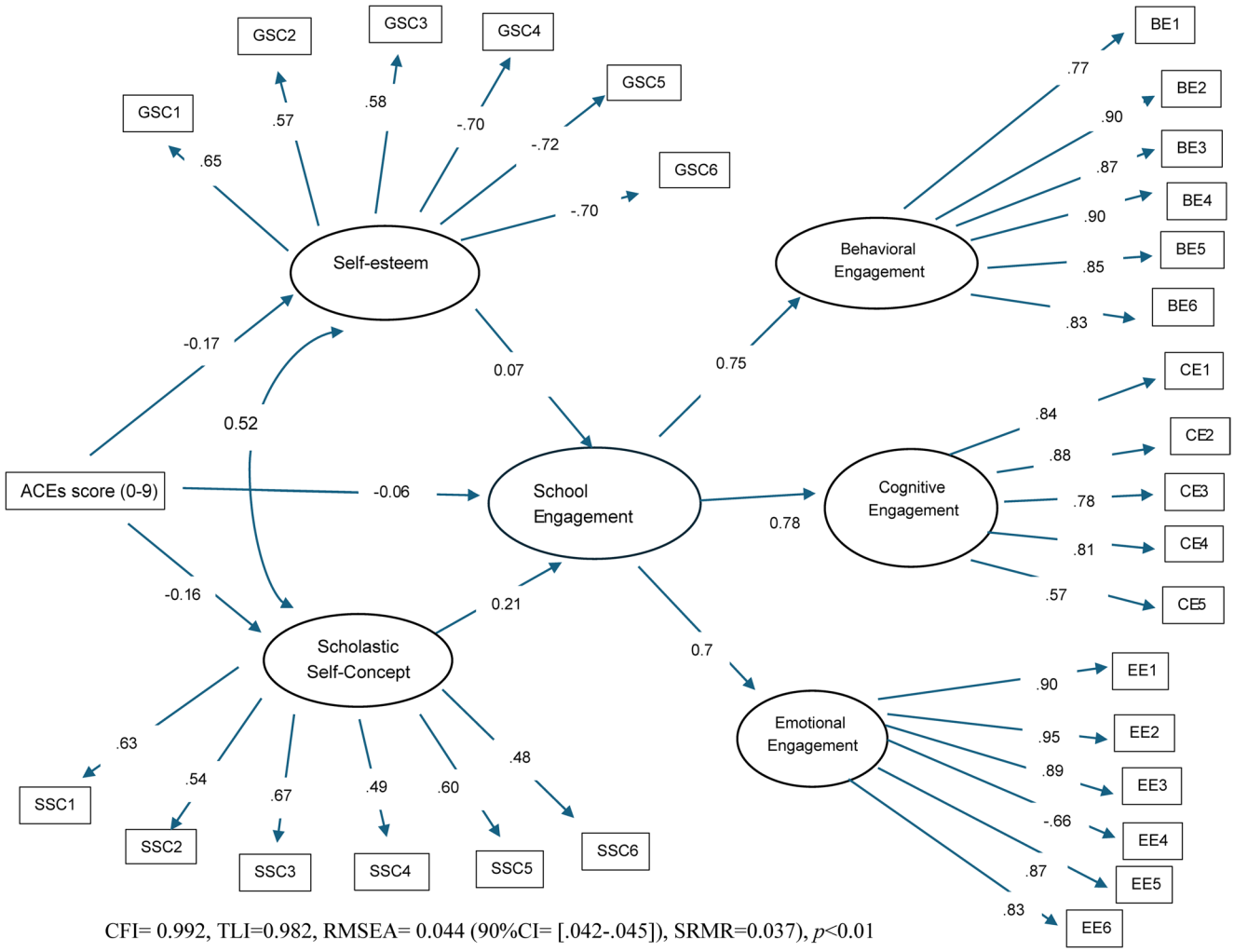

Fig. 2 Final mediating model linking ACEs (up to age 8) to school engagement (at age 12) through self-steem and scholastic self-concept (at age 8)

were standardized for ease of interpretation of the magnitude of the effect. For clarity purposes, paths linking the covariate variables (gender and NZ deprivation) to other variables in the model were removed from Fig. 2.

A negative direct association was found between ACEs and school engagement (β=-0.06, $p<0.01$, 95% CI: -0.09, -0.02). Also, exposure to ACEs was negatively associated with self-esteem (β=-0.17, $p<0.001$, 95% CI: -0.19, -0.12) and scholastic self-concept (β= -0.16, $p<0.001$, 95% CI: -0.18, -0.11). Self-esteem (β=0.07, $p<0.05$, 95% CI: 0.01, 0.12) and scholastic self-concept at 8 years old were positively (β=0.21, $p<0.001$, 95% CI: 0.16, 0.27) associated with school engagement at 12 years old (Fig. 2). The indirect (mediated) effect of self-esteem and scholastic self-concept on school engagement was significant (β=-0.043, $p<0.001$, 95% CI: -0.05- -0.03).

The model indicated a good fit with CFI=0.992, TLI=0.982, RMSEA=0.044 (90%CI= [0.042-0.045]), SRMR=0.037).

Subgroup Analysis

Measurement and Structural Invariance

Table 2 presents the model fit indices for the 5 models described previously to assess both the measurement and structural invariances across 4 ethnic groups. The multiplegroup configural model, with no constraints except the same factor pattern/structure across groups, showed a good fit to the data (CFI=0.993, RMSEA=0.045). Subsequently, Model 2 introduced constraints on the factor loadings, requiring them to be equivalent across ethnicity groups. While having good fit indices, Model 2 (metric) had slightly lower CFI and larger RMSEA (ΔCFI=-0.001<-0.01, ΔRMSEA=0.001<0.015) compared to Model 1, which demonstrates that metric invariance across the ethnicity groups. Building upon this foundation, Model 3 (scalar) was established, where both factor loadings and item thresholds were constrained to be equal across groups. This model was

Table 2 Sequential invariance model fit statistics across four ethnic groups

	CFI	TLI	RMSEA	90%CI	SRMR	ΔCFI	ΔRMSEA
Measurement of invariance							
Model 1: Configural model	0.993	0.992	0.045	0.043-0.046	0.046		
Model 2: Metric	0.992	0.992	0.046	0.044-0.047	0.048	-0.001	0.001
Model 3: Scalar	0.992	0.992	0.043	0.041-0.044	0.048	0	-0.002
Structural invariance							
Model 4: Configural model	0.993	0.993	0.042	0.040-0.043	0.046		
Model 5: Regression	0.993	0.993	0.043	0.041-0.045	0.047	0	0.001
Model 6: Path between self-esteem and school engagement fixed	0.992	0.992	0.041	0.041-0.045	0.046	-0.001	-0.004
Model 7: Path between scholastic self-concept and school engagement fixed	0.992	0.992	0.041	0.041-0.045	0.047	-0.001	-0.004
Model 8: Path between ACEs and school engagement fixed	0.992	0.992	0.041	0.041-0.045	0.046	-0.001	-0.004
Model 9: Path between ACEs and self-esteem fixed	0.992	0.992	0.041	0.041-0.045	0.047	-0.001	-0.004
Model 10: Path between ACEs and scholastic self-concept fixed	0.992	0.992	0.041	0.041-0.045	0.046	-0.001	-0.004

a better fit to the data as evidenced by having the same CFI as the configural model (CFI = 0.993) and improvements in the RMSEA (0.043). Thus, scalar invariance across the groups was also confirmed.

Results of the structural invariance analysis revealed that the SEM model demonstrated strong invariance across the four ethnicity groups. After constraining all path coefficients to be equal across groups, the model had the same CFI of 0.993 as the configural model in which all path coefficients were free. This suggests that the regression paths remain consistent irrespective of ethnicity (Table 2). We also constrained each path separately in a different model and compared the CFI with the CFI for the configural model. In all models (Models 6 to 10), the difference between CFIs was less than 0.001 (Table 2). Moreover, the model was evaluated for each ethnic group, and despite variations in the path coefficients, it demonstrated a strong fit across all groups. To explore potential selection effects, we compared participants and non-participants in DCW12 regarding ACEs exposure and self-concept. Results suggest that individuals with higher ACEs were more likely to drop out by wave 12, and those who dropped out at wave 12 had lower self-concept scores at wave 8 compared to those who continued participation.

Association Between Individual ACEs, Self-esteem, Scholastic Self-concept, and School Engagement

The analysis examining the association between ACEs, self-esteem, and scholastic self-concept, and school engagement showed that, after controlling for covariates, nearly all individual ACEs had a significant negative association with these outcomes, with the exceptions of parental mental illness and mothers' experiences of discrimination (Supplementary Table 2). Particularly, exposure to peer-bullying, parental separation or divorce, parental incarceration, and emotional abuse had significant associations with all three of these variables (β ranging from −0.04 to -0.28). Exposure to peer-bullying had the strongest association with self-esteem (β =-0.28, 95% CI:- 0.31 to -0.24), scholastic self-concept (β =-0.20, %95CI: -0.20 to -0.16), and school engagement (β =-0.10, 95% CI: -01.3 to -0.06) (Supplementary Table 2). All SEM models exhibited good fit, with CFI and TLI values ranging from 0.97 to 0.99, and RMSEA and SRMR ranging from 0.04 to 0.07; these values are excluded from the table for ease of presentation.

Discussion

This study investigated the association between ACEs and school engagement and the mediating effect of self-concept in this association, using a longitudinal design and latent variable modelling within a large, ethnically diverse NZ cohort. We also tested the invariance of the proposed model in four ethnic groups (Māori, Pacific, Asian, and European/New Zealander/Other) in NZ. Using a relatively broad measure of ACEs and school engagement in GUiNZ, we found that exposure to ACEs is associated with lower levels of school engagement. Importantly, we also found a longitudinal mediating effect of self-esteem and scholastic self-concept at age 8 in the link between ACEs in early childhood (up to age 8) and diminished school engagement in middle childhood at age 12. The mediating effects of self-esteem and scholastic self-concept were invariant across four ethnic groups, lending cross-cultural robustness to a pathway that had not previously been tested in this way within the NZ context.

Using a prospective design, our results indicate the negative longitudinal association between childhood adversity (up to age 8) and school engagement in middle childhood (age 12), which reinforces previous cross-sectional and regression-based investigations into this association (Bethell et al., 2014; Crouch et al., 2019; Robles et al., 2019; Webb et

al., 2022). This reduced school engagement could be a result of cognitive, psychological, social, and behavioral changes resulting from trauma (Rumsey & Milsom, 2018). Previous research suggests that some mechanisms, such as poor kindergarten student-teacher relationship quality and elevated third-grade internalizing problems, mediate the link between early adversity and reduced school engagement (McDoniel & Bierman, 2023). Similarly, emotion regulation skills have been found to mediate the impact of trauma symptoms on school engagement (Mullins & Panlilio, 2023).

Extending prior research on the mechanisms linking ACEs to school engagement, our study demonstrates that self-concept, including self-esteem and scholastic self-concept, may play a crucial mediating role in this link. Self-concept is a key factor in shaping individuals' responses to adversity (Thoits, 2013) and significantly mediates the negative effects that may occur after an experience of abuse (Berber Çelik & Odacı, 2020). When children are exposed to adversity, they might be at increased risk of developing feelings of worthlessness, self-doubt, and reduced competence, which could be rooted in unstable interpersonal relationships and impaired attachment formation (Downey & Crummy, 2022). Students with low self-belief may have psychological and cognitive challenges and experience negative emotions such as frustration and anxiety, along with disengaged behaviors like distraction and passivity (Acosta-Gonzaga, 2023; Perry & Szalavitz, 2006). Moreover, a lack of confidence can reduce children's motivation, willingness to take academic risks, and overall engagement in learning (APA, 2024). If self-esteem is low, it may result in various indices of maladjustment, such as less engagement in beneficial extracurricular activities, lower academic performance, less interaction with teachers, and less perceived support (McClure et al., 2010; Tetzner et al., 2016), which have the potential to negatively affect school engagement (Perdue et al., 2009; Wang et al., 2019).

The findings from our multigroup analysis suggest that the self-concept and school engagement instruments used in this study are interpreted similarly by students from different ethnic backgrounds and function consistently across Māori, Pacific, Asian, and NZ European students. The findings also indicate that self-esteem and scholastic self-concept significantly influence the link between ACEs and school engagement, regardless of ethnicity. These findings add to the literature that shows the invariance of the self-concept (Michaels et al., 2007) and school engagement (Rubie-Davies et al., 2015). These invariance findings should be interpreted in light of the sample composition and the diversity of school settings, as discussed further in the Limitations section.

Although not the primary focus of the study, our prospective analysis highlights the association between peer-bullying, parental separation or divorce, parental incarceration, and emotional abuse with multiple outcomes. These findings reinforce previous research on the link between these adversities and child's outcomes such as self-concept and school engagement (Berber Çelik & Odacı, 2020; CDC, 2023; Crouch et al., 2019; Webb et al., 2022). Additionally, our findings contribute to the growing body of literature that suggests peer-bullying has an important impact on adolescents' psychosocial well-being and educational performance (CDC, 2023; Finkelhor et al., 2013; Li et al., 2020; WHO, 2022), and advance this literature by quantifying the relative strength of these associations within a prospective NZ cohort. These results underscore the importance of early identification and intervention strategies to mitigate the negative effects of bullying on children's and adolescents' self-concept and school engagement. Future research could further explore these patterns to better understand their long-term implications.

Implications

The reverse relationship between ACEs and school engagement identified in our study emphasizes the need for primary ACE prevention strategies. Such strategies include strengthening family support services, promoting non-violent attitudes, beliefs, and behaviors, and providing access to free or low-cost, evidence-based parent training (CDC, 2024). These approaches are essential for creating a more inclusive and supportive environment in a country like NZ with a high prevalence of ACEs (Hashemi et al. 2025b). Moreover, as previous research using the same sample has shown, ACEs are more prevalent among Māori (Hashemi et al. 2025b; Mellar et al. 2025), who also face the compounded effects of racism and colonization (Joy & Beddoe, 2019; Pihama et al., 2014). Therefore, these disparities should be considered in prevention efforts. Our findings also highlight the importance of identifying children exposed to ACEs, as this can facilitate targeted support, early intervention, efficient resource allocation (McKelvey et al., 2017) as well as resilience-building strategies for these children. In the school setting, personnel such as nurses, teachers, and counselors are often the first to be aware of adverse events and can also notice subtle changes in school engagement through parent communication, routine check-ins, and extended observation of children's behavior and performance (Walker & Walsh, 2015). This allows schools to directly assist at-risk children or connect them and their families with community resources to access necessary support (Walker & Walsh, 2015). To be effective, however, identification must be embedded within well-designed school systems of care, with clear pathways for follow-up support. This ensures that

early identification translates into timely and meaningful assistance at critical points in children's development.

A trauma-informed approach in schools is also an important initiative that can help children exposed to ACEs to have better school engagement. Trauma-informed practices are grounded in the concept of neuroplasticity, which shows that positive, nurturing environments can promote healthy brain changes and help reverse the effects of trauma (Peckham, 2023). Implementing such approaches in schools has provided a crucial opportunity to address the impacts of complex trauma during the school years (Howard, 2019). In a trauma-informed school, actions are viewed as misapplied survival skills instead of classifying them as maladaptive behaviors, and has the goal of holistically supporting all students, but especially trauma-impacted ones, by minimizing trauma's harmful grip and maximizing students' ability to thrive in school and beyond (Wall, 2021). These schools emphasize establishing positive bonds between children and staff as a means of providing healthy, unconditional care from non-parental adults. Moreover, they focus on creating clear and predictable school structures with consistent routines, expectations, and limits while seeking to empower children with agency over their environment by giving them opportunities to negotiate, express interests, and share opinions (Wall, 2021).

Teachers play a crucial role in fostering students' resilience within a trauma-informed framework, helping them maintain good functioning despite adversities (Luthar & Mendes, 2020). However, when examining the challenges of implementing a trauma-informed approach, it is evident that teachers face significant daily stress and burnout due to under-resourced school environments as well as routinely providing empathic support to troubled students in classrooms. Moreover, many teachers do not feel adequately competent in their abilities to assist their students with regard to trauma (Luthar & Mendes, 2020). Even school-based mental health professionals have reported insufficient professional training competencies necessary for trauma-informed care (Luthar & Mendes, 2020). To address these challenges, continuous support for teachers (Luthar & Mendes, 2020) and, more broadly, allocation of social, emotional, and behavioral resources to schools is crucial (Luthar & Mendes, 2020; Maynard et al., 2019).

In the NZ context, the implementation of trauma-informed approaches is evolving but significant gaps remain across settings. In schools, for example, behavioral responses are still frequently managed through disciplinary measures such as suspension, stand-down, or exclusion, which risk overlooking the underlying drivers of behavior. Moreover, schools are often not equipped to recognize and respond effectively to adversity, increasing the likelihood that behavioral expressions of distress are misinterpreted as disciplinary issues rather than indicators of unmet need. This reflects broader constraints, including limited integration of trauma-informed practice within teacher education and professional development, as well as insufficient time, funding, and resources to support implementation.

More broadly, the development of trauma-informed approaches in NZ requires careful consideration of local contexts, rather than direct adaptation of overseas methods. Whilst everyone uniquely experiences trauma, Māori are more likely to experience it in ways that are specifically linked to colonization, racism, discrimination, historical negative stereotyping, inequitable access to education, and disproportionate rates of violence, poverty, and poor health outcomes (Bishop & Berryman, 2007; Pihama et al., 2017; Te Pou, 2023). These additional layers of trauma must be acknowledged and understood when shaping trauma-informed education in NZ.

The mediating effect of self-esteem and scholastic self-concept in the link between ACEs and school engagement identified in our findings could be a key area for intervention to help children with a history of adversity engage more effectively with school. A school environment that encourages student choice, creative expression, and initiative can improve self-concept (Coleman, 1961), ultimately leading to greater school engagement. Additionally, research highlights that programs like extended music curricula, using group guidance activities, and encouraging students to engage in sports at schools can help them develop a positive academic self-concept and self-esteem (Degé & Schwarzer, 2017; Mendo-Lázaro et al., 2017; Yusop et al., 2018). Counselors can be another crucial component in boosting students' self-esteem; by using methods such as a person-centered approach to promote self-esteem in school settings (Lusiana & Basuki, 2020). Teachers, in particular, can help build children's confidence by giving them opportunities to succeed, encouraging them, expressing belief in their abilities and supporting their autonomy (Granero-Gallegos et al., 2023; Pugnerová & Pospíšilová, 2020). Given the contributions of school environment, counselors and teachers, it is imperative that schools prioritize the creation and maintenance of such environments to optimize students' self-esteem.

Limitations and Future Research

Firstly, it should be noted that the ACEs index created in this study represents one pragmatic operationalisation of childhood adversity among many possible approaches. Like any ACEs measure, it is necessarily selective and cannot fully capture the breadth, nuance, or cultural specificity of adversity in NZ, nor experiences of adversity that may emerge as definitions evolve over time. Additionally, while this study

incorporates a prospective design, the temporal ordering of the variables requires careful interpretation. ACE exposure was measured cumulatively up to age 8, and self-concept was also assessed at age 8, limiting the ability to establish a clear temporal separation between exposure and the proposed mediator.

Another key limitation of our study is attrition in the GUiNZ cohort, which resulted in a more homogeneous sample over time, with a larger proportion of NZ European children and those from lower-deprivation areas (Napier et al., 2024). Prior research indicates that children who experience adversity are more likely to drop out (Hashemi et al. 2025a), and in this study, those with high ACEs were less likely to remain in wave 12. Additionally, those who dropped out at wave 12 had lower self-concept scores at wave 8 compared to those who continued participation. As a result, the remaining sample within each ethnic group might be more similar to each other than the true population. This could reduce between-group differences and contribute to finding structural invariance, even if real differences could still exist. Moreover, the unequal representation of ethnic groups, with NZ European children comprising more than half of the sample, may have affected the detection of noninvariance (Chen, 2007). Therefore, our results may not fully generalize to all socioeconomic and ethnic groups, and the observed effects could differ in a more diverse and representative sample. More research is required to further test this mediating effect in a more ethnically diverse sample. Future research could also benefit from examining the proposed mechanism using a self-concept construct that considers the cultural heritage of Māori students. This is particularly important because ACEs have a higher prevalence in underrepresented groups such as Māori, compared to the NZ European group (Fanslow et al. 2021; Hashemi et al. 2025a), with racism and poverty compounding these effects (Joy & Beddoe, 2019).

The invariance findings also require careful contextual interpretation, particularly in relation to the school setting and cultural context. While the analysis was exploratory in nature, and followed a standard sequential testing procedure (configural → metric → scalar) guided by established fit criteria, school type was not included as a variable in the analysis. Children in the GUiNZ cohort attended a range of school settings at DCW12, including a small number of students (n = 53) attending kura kaupapa Māori (Māori-language immersion schools in NZ, operating under Māori cultural and educational principles). However, given that kura kaupapa Māori students represented only a small proportion of the sample, the invariance findings predominantly reflect the experiences of students in other school settings and may not accurately represent the experiences of Māori children in kura kaupapa Māori settings. We are therefore unable to determine whether the observed invariance holds within kura kaupapa Māori settings, where engagement may be understood and expressed through distinctly different cultural and linguistic frameworks (Tocker, 2007). Future research should examine whether these pathways hold consistently across different school settings, particularly kura kaupapa Māori.

Our ACEs measure includes maternal experiences of discrimination and children's exposure to peer bullying, which is valuable for capturing wider social factors affecting school engagement. However, additional information is necessary to fully understand the complex interplay of institutional, structural, and social influences on school engagement. While self-esteem and scholastic self-concept showed modest mediating effects in this study, other potential pathways remain underexplored. We recommend that future research investigate other potential mediators, such as student-teacher relationships, teacher expectations, school climate, and social support, to further elucidate the factors linking ACEs to school engagement.

A further limitation relates to the measurement of school engagement. The scales used to operationalize behavioral, cognitive, and emotional engagement were developed primarily in Western contexts and, with the exception of the SPPCC, have not been formally validated in NZ. While these measures capture meaningful dimensions of engagement, they represent one operationalisation among many and cannot fully reflect the breadth or cultural specificity of engagement for all students in the cohort. In particular, culturally specific forms of engagement for Māori and Pacific students — such as those rooted in relational, communal, or indigenous knowledge frameworks — may be underrepresented by these researcher-defined scales.

Conclusion

This study demonstrates that exposure to a greater number of adversities by age 8 is associated with lower levels of school engagement at age 12, even after adjusting for gender and area deprivation level. This effect occurs by undermining children's self-esteem and scholastic self-concept, which highlights how early adversity can shape educational trajectories through internalized negative self-perceptions. Our use of a longitudinal design and a relatively broad ACEs index for GUiNZ cohort, along with comprehensive measurement of school engagement, strengthens confidence in these findings and enables a nuanced understanding of long-term developmental processes. Applying SEM and testing for measurement and structural invariance allowed us to rigorously assess the

relationship between ACEs and school engagement while establishing the cross-group validity of our findings across four major ethnic populations in NZ. Testing for measurement and structural invariance across four ethnic groups further ensures that these findings reflect consistent underlying processes, although contextual factors should be considered in their interpretation. Taken together, the methodological choices allowed us to affirm prior theoretical accounts of the ACEs–school engagement relationship with greater confidence, and to extend them into an NZ context where longitudinal evidence of this kind has been lacking as a more rigorous and contextually grounded contribution to an important field. Our findings highlight the importance of preventing ACEs, early identification of at-risk children, and prioritizing trauma-informed, equitable, and culturally sensitive interventions to improve school engagement. These findings also deepen our understanding of the long-term consequences of childhood adversity and point to the importance of fostering positive self-concept as a potential target for intervention.

Data Availability

The data utilized in the submitted manuscript was collected by the Growing Up in New Zealand study team. Researchers seeking access to this data may apply by submitting a data access application to the Data Access Committee at https://www.growingup.co.nz/using-data. The analyses pre sented here were not preregistered.

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Authors' Contributions Maryam Ghasemi: conceptualization, methodology, statistical analysis, and writing the original draft. Kane Meissel: conceptualization, review, editing, and supervision. Tracey McIntosh: review, editing, and cultural advice. Ladan Hashemi: conceptualization, methodology, review, editing, and supervision. All authors contributed to the article and approved the submitted version.

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Declarations

Public Relevance Statement These findings underscore the importance of preventing ACEs, identifying at-risk children early, and implementing trauma-informed, equitable, and culturally sensitive interventions that strengthen self-concept and support school engagement.

Conflict of interest The authors declare that they have no conflicts of interest.

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