



Relative deprivation and aggressive behavior: The serial mediation of school engagement and deviant peer affiliation

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ABSTRACT

According to previous studies and ecological systems theory, relative deprivation may influence aggressive behavior, and individual contexts may mediate this relationship. The present study examined whether and how the factors of ecological microsystems (i.e., school engagement and deviant peer affiliation) act as serial mediators in this relationship. To investigate this issue, the current study surveyed 1153 adolescents (601 males, 52 %, mean age = 14.76, $SD = 1.64$) who enrolled in six middle and high schools in Guangdong and Henan provinces, China. The serial mediation model was used to test the relationship between relative deprivation, school engagement, deviant peer affiliation, and aggressive behavior. The study's results support the serial mediation of school engagement and deviant peer affiliation, providing a promising serial mediation pathway for intervening in adolescents' aggressive behavior. Specifically, the mediation pathway of deviant peer affiliation was significant. However, the effect of relative deprivation through the mediating effect of school engagement is significant only with the serial mediation of deviant peer affiliation. Relative deprivation presented a risk for the aggressive behavior of adolescents and the effect of relative deprivation was serially mediated by school engagement and deviant peer affiliation. Implications and interventions for educational strategies about aggressive behavior must consider factors related to the individual (relative deprivation), school, and peers.

1. Introduction

Due to extensive reforms and progressive openness, China's income distribution is unequal. Individuals who compare themselves with others often experience relative deprivation due to differences in family capital and socioeconomic backgrounds (Chen et al., 2021; Xu et al., 2022; Xuan et al., 2021). Relative deprivation refers to the subjective perception of being in an unfair and disadvantaged state, deprived of basic rights compared to a reference level, and the feeling of legitimately wanting more, including cognitive (subject perceptions of deprivation) and emotional (negative feelings about deprivation) components (Smith et al., 2012; Smith et al., 2018). According to social comparison theory, individuals evaluate themselves through comparisons with others (Bronfenbrenner, 1977); during this process, if they perceive a disadvantage and view it as unfair, it can lead to feelings of angry resentment, resulting in relative deprivation (Smith et al., 2012). In adolescents, social comparisons across various aspects, such as friendship, family economic status, and academic achievement, can induce feelings of

relative deprivation (Tian et al., 2021). When individuals experience high levels of relative deprivation, they often face psychosocial stress and seek ways to alleviate the resulting tension (Stark, 2020). This stress can lead to negative outcomes, such as engaging in risky behaviors (Balsa et al., 2014), reduced happiness (Luttmer, 2005), long-term health decline (Park, 2020), and even increased mortality (Deaton & Lubotsky, 2003).

Adolescence is a crucial and sensitive stage of socialization, focused on school life and relationships with peers (Tian et al., 2019b; Wiium & Wold, 2009; Zhu et al., 2016). During this period, high levels of relative deprivation may negatively impact adolescents' interaction in school and peer groups (Esposito & Villaseñor, 2019; Yang et al., 2021). Ecological systems theory shows that aggressive behavior as problem behavior is the consequence of the breakdown of important multiple microsystems rather than a single social factor (Tian et al., 2019b; Wiium & Wold, 2009; Zhu et al., 2016). Therefore, the negative perception of relative deprivation as a subjective personal perception obtained by comparing others in social contexts may lead to aggressive

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behavior through multiple microsystems, such as school and peers (Neal & Neal, 2013; Smith et al., 2012).

Although previous studies have found that adolescents with high relative deprivation exhibit higher levels of aggressive behavior (Greitemeyer & Sagioglou, 2017; Jiang & Chen, 2019; Kassab et al., 2021; Tian et al., 2023), the literature has not fully clarified why and how relative deprivation increases aggressive behavior. This gap in understanding the mechanisms of influence is noteworthy because, although relative deprivation is due to unequal income distribution, comprehending these mechanisms will inform the development and implementation of more viable interventions aimed at preventing adolescents' aggression and school bullying. This study utilizes the relative deprivation scale developed by Tian et al. (2021), which measures five aspects of social comparison among Chinese adolescents, and integrates the school and peer microsystems to explore how relative deprivation contributes to adolescent aggression.

1.1. Relative deprivation and aggressive behavior

Aggressive behavior refers to "any behavior intended to harm another person who does not want to be harmed" (DeWall et al., 2011). Previous studies have provided evidence of the link between relative deprivation and aggressive behavior. For example, in a game task, Kassab et al. (2021) found that relative deprivation makes individuals display more aggressive behavior. Furthermore, Jiang and Chen (2019) adopted an experimental approach to test the causal association between relative deprivation and aggression among Chinese adolescents. They demonstrated that individuals who perceive high relative deprivation are more aggressive on average. Hence, this study contends that perceived relative deprivation may positively predict adolescents' aggressive behavior.

A widely used model of adolescent aggressive behavior is the General Aggression Model, which indicates that the behavior of an individual depends upon their internal psychological states, such as arousal, cognition, and emotion, with one or more of these factors contributing to aggressive behavior (Anderson & Carnagey, 2004). The literature suggests that an individual's internal state of relative deprivation, such as the perceived equity gap and the feeling of legitimately wanting more, may explain the effect of relative deprivation on aggressive behavior (DeWall et al., 2011; Smith et al., 2012; Zhang et al., 2021). Specifically, for adolescents who focus on socialization, social comparison is an important factor of the present environment linked to their internal state (Anderson & Carnagey, 2004; DeWall et al., 2011). When adolescents perceive high relative deprivation, they perceive low social status and experience negative emotions as the components of relative deprivation (Harenski & Kiehl, 2010; Smith et al., 2012; Smith et al., 2018). Therefore, they may seek to improve their situation and reduce negative emotions through aggressive behavior (Anderson & Carnagey, 2004; Jiang & Chen, 2019; Martins et al., 2022; Tseng et al., 2013).

1.2. Mediating roles of school engagement

School engagement is a multidimensional and multifaceted construct comprising three dimensions, namely, students' behaviors, cognition, and emotional engagement (Fredricks et al., 2004). School as an important microsystem has been recognized by ecological systems theory (Darling, 2007; Neal & Neal, 2013). Knowledge of school engagement may help decrease the likelihood of aggressive behavior shaping adolescents caused by relative deprivation.

The impact of relative deprivation on three dimensions of school engagement may serve to elucidate the effects of relative deprivation. First, relative deprivation may reduce behavioral engagement in school. Previous research has demonstrated that injustice and social distance arising due to relative deprivation may decrease adolescents' motivation to engage in school activities (Esposito & Villaseñor, 2019; Irvin, 2012; Molinari & Mameli, 2018). In addition, the negative emotional

component of relative deprivation interferes with adolescents' interest in school activities (Hernandez et al., 2018; Kwon et al., 2018). Second, the subjective cognition of lower social status in relative deprivation may develop conflicted identities and decrease adolescents' motivation toward cognitive engagement in school (Esposito & Villaseñor, 2019; Nieuwenhuis & Chiang, 2021; Park, 2021). Third, adolescents with high levels of relative deprivation exhibit higher levels of social isolation and lower levels of school belonging than others, which causes a decrease in emotional school engagement (Esposito & Villaseñor, 2019; Lee et al., 2022).

Previous studies have explored a negative relationship between school engagement, as an adaptive factor, and aggressive behavior (Duggins et al., 2016; Lin et al., 2020; Martins et al., 2022). Adolescents with low-level school engagement are unlikely to conform to school norms, values, expectations, and regulations, which increases the risk of aggressive behavior (Konold et al., 2017; Lin et al., 2020). For example, a longitudinal study with multiple waves involving 732 adolescents has demonstrated that school engagement has a negative impact on aggressive behavior among Chinese adolescents (Lin et al., 2020). Given the potential negative effect of relative deprivation on three dimensions of school engagement, as well as the role school engagement appears to play in reducing adolescents' aggressive behavior, it is necessary to explore the role of school as a microsystem in the mechanism linking relative deprivation to aggressive behavior. Adolescents may lose school engagement due to perceived relative deprivation in the process of social comparison. Then, the low-level engagement in school further affects their aggressive behavior as a form of school disobedience. Therefore, this study contends that school engagement mediates the relationship between relative deprivation and adolescents' aggressive behavior (H1).

1.3. Mediating roles of deviant peer affiliation

Peers are a critical microsystem and have a significant impact on adolescent behavior among various ecological factors (Bronfenbrenner, 2005; Darling, 2007; Lin et al., 2020). Deviant peer affiliation, a negative form of a peer relationship, refers to the association with peers engaging in problematic behavior, such as illegal activities or immoral behavior (Rudolph et al., 2014).

Previous studies have indicated that low subjective social status and negative emotions due to perceived relative deprivation may increase the risk of deviant peer affiliation because deviant peers are usually perceived to have higher social status and more autonomy among adolescents (Jia et al., 2017; Yang et al., 2021). Hence, adolescents may be affiliated with deviant peers to fulfill their unmet needs of social status and support when they perceive relative deprivation (Callan et al., 2008; Yang et al., 2021). In turn, adolescents may seek the acceptance of deviant peers by adopting similar behaviors, including aggressive behavior, and this may become reinforced by the pressure of peers, which increases the risk aggressive behavior (Lin et al., 2022; Lopez-Fernandez et al., 2021). It is reasonable to suspect that relative deprivation affects adolescents' aggressive behavior via deviant peer affiliation.

Relative deprivation may affect adolescent socialization as increasing evidence shows that relative deprivation is a harmful factor in developing peer relationships and leads to deviant peer affiliation (Callan et al., 2008; Yang et al., 2021). For instance, Yang et al. (2021) found that adolescents who perceive a high level of relative deprivation due to social comparison are more likely to satisfy their needs through deviant peer affiliation due to being less restricted by the rules and the higher social status of deviant peers. In addition, deviant peer affiliation has been found to induce pressure to conform to deviant peers' behavior, leading to increased aggressive behavior (Bao et al., 2022; Chapple et al., 2014). Previous longitudinal studies have demonstrated that deviant peer affiliation is a reliable predictor of aggressive behavior in adolescents (Lin et al., 2022; Lopez-Fernandez et al., 2021; Zhu et al., 2017).

The ecological systems theory and available evidence provide support for the effects of deviant peer affiliation on adolescents' aggressive behavior. Based on these mechanisms and evidence, it is hypothesized that relative deprivation, via deviant peer affiliation, has an impact on adolescent aggressive behavior (H2).

1.4. Mediating roles of school engagement and deviant peer affiliation

Both school and peers are important contextual factors that impact adolescent development. Ecological systems theory emphasizes the collaboration among various microsystems rather than a single factor in shaping adolescent behavior, and affiliation with peer relationships is embedded in social context (Bao et al., 2022; Bronfenbrenner, 1977). The peer groups surrounding school-aged adolescents typically consist of other youths from the same school, grade, class, or community (Jiang, 2023). This also highlights the critical role of the school microsystem in shaping peer interactions and relationships for shaping peer affiliation (Bao et al., 2022).

Social Control Theory (Hirschi, 1969) and the Social Development Model (Hawkins & Weis, 1985) emphasize the critical role of social bonds and socialization experiences in the internalization of values and norms. Specifically, socialization experiences lead adolescents to internalize the behaviors, norms, and values of those with whom they are closely bonded. Hence, adolescents who are strongly engaged in school are more likely to identify with and internalize the positive expectations of their teachers, which helps protect them from affiliating with deviant peers and, in turn, reduces the likelihood of engaging in problematic behaviors (Bao et al., 2022; Lin et al., 2020; Rudasill et al., 2014). Conversely, adolescents with low levels of school engagement may deviate from prosocial bonds, seeking instead to affiliate with deviant peers. This shift can increase the risk of aggressive behavior due to social pressure and reinforcement within deviant peer groups (Ryan & Deci, 2000; Wang & Fredricks, 2014; Yang et al., 2021). Consistent with these views, several studies have shown the impact of school microsystem on adolescents' peer affiliation (Bao et al., 2022; Zhu et al., 2015). For example, Lin et al. (2020) and Zhu et al. (2015) found that school engagement negatively predicts subsequent deviant peer affiliation through longitudinal studies.

Based on theoretical perspectives and empirical evidence, we speculate that the level of engagement with school influences adolescents' affiliation with deviant peers. Adolescents occupy the center of multiple ecological systems. Specifically, low levels of school engagement due to relative deprivation hinder adolescents from internalizing expectations from teachers and other school figures. This, in turn, fosters stronger affiliations with deviant peers, ultimately increasing the likelihood of engaging in aggressive behavior under the influence of these peer groups. Although theories and previous research has provided evidence of the effects of school and peer microsystems, no study has investigated the roles of both microsystems in the relationship between relative deprivation and aggressive behavior. According to the ecological systems theory, it is essential to examine the roles of both the school and peers, as their significantly influence adolescent development. Thus, the current study hypothesizes that the relationship between relative deprivation and aggressive behavior is serially mediated by school engagement and deviant peer affiliation (H3).

2. Methods

2.1. Participants

This study utilized a convenience sampling method, drawing participants from six middle and high schools in the Chinese provinces of Guangdong and Henan. A total of 1,500 questionnaires were distributed to participants, and 1,348 were returned, yielding a response rate of 89.87 %. After excluding participants who withdrew during the survey process, those with substantial missing data, and those with patterned

responses in the key variable questionnaires, the final valid sample comprised 1153 adolescents (601 males, 52.1 %), resulting in a validity rate of 85.55 %. The age of the participants ranged from 11 to 18 years old; $M_{age} = 11.25$, $SD = 1.69$). In addition, 62.3 % of the participants declared a family per capita monthly income between ¥1000 and ¥3000, 9.5 % below ¥1000, and 8.0 % above ¥9000. Table 1 provides details information of demographic characteristics of current study.

2.2. Procedure

Ethical approval was acquired from the author's institution. Participants were recruited in January 2019, and all participants responded to the survey before March 2019. Participants responded the survey by class to prevent them from answering the questionnaire twice. We obtained written consent from adolescent, school administrators, and the participants' parents and teachers. Trained psychology teachers or graduate students in psychology collected the data. Before data collection, we described the study's purpose and guaranteed privacy to the participants, informing them that they were free to withdraw at any time during the data collection process. Given the cross-sectional design of this study, we ensured complete anonymity by not collecting any personally identifiable information, such as names or student numbers, to encourage honest reporting. All participants completed the self-reported questionnaire in approximately 20 min in their regular classroom. There were stationary rewards for participants.

2.3. Measures

2.3.1. Relative deprivation

We used a 10-item Chinese version of the Adolescents' Relative Deprivation Scale to assess relative deprivation (Tian et al., 2021). This scale includes two subscales: the cognitive subscale measures perceptions of deprivation across five aspects of social comparison (e.g., friendship, family economic status, achievement, opportunities, and

Table 1
Demographic Characteristics (N = 1153).

Variable	% (n)
Gender of adolescent	
Male	52.1(601)
Female	47.9(552)
Fathers' Education	
Below high school	35.4(408)
High school diploma	27.1(313)
Associate degree	12.2(141)
Bachelor's degree	16.8(194)
Graduate degree (Masters or PhD)	2.9 (33)
Mothers' Education	
Below high school	41.9(483)
High school diploma	23.2(267)
Associate degree	15.2(175)
Bachelor's degree	11.0(127)
Graduate degree (Masters or PhD)	2.6(30)
Per Capita Family Income (Monthly)	
Less than ¥1,000	9.5(109)
¥1,000 to ¥2,000	13.3(153)
¥2,000 to ¥3,000	16.9(195)
¥3,000 to ¥4,000	12.7(146)
¥4,000 to ¥5,000	8.9(103)
¥5,000 to ¥6,000	4.8(55)
¥6,000 to ¥7,000	4.9(57)
¥7,000 to ¥8,000	3.2(37)
¥8,000 to ¥9,000	2.9(33)
More than ¥9,000	8.0(92)
Living with Parents	
Living with both parents	74.7(861)
Living with father or mother	13.9(160)
Neither parent present	7.5(87)

Note. Because some adolescents preferred not to disclose specific information, some percentages may not sum to 100.

pocket money), and the emotional subscale assesses the emotional component corresponding to these same five aspects. The two-component scale can effectively reflect the level of relative deprivation and has demonstrated adequate reliability and validity among Chinese adolescents (Tian et al., 2021; Tian et al., 2023). Adolescents reported the cognitive (e.g., “Compared to my friends, my parents are generally less supportive of me than their parents are of them”) and emotional (e.g., “I am frustrated by my pocket money relative to my friends”) relative deprivation experienced in their life. We rated all items on a five-point scale ranging from one (*strongly disagree*) to five (*strongly agree*). The mean scores of the 10 items reflect the level of relative deprivation, with higher scores indicating a greater degree of relative deprivation. The Cronbach’s alpha coefficient for the current sample is 0.88.

2.3.2. School engagement

School engagement was measured using a questionnaire adopted by Wang et al. (2011). The questionnaire assesses three types of school engagement: behavioral engagement (e.g., “How often do you have trouble paying attention in classes?”), cognitive engagement (e.g., “How often do you try to carry out the plans you make for solving problems?”), and emotional engagement (e.g., “In general, I feel like a real part of this school”). All items are rated on a five-point Likert scale. Behavioral and cognitive engagement are rated on a scale from one (*almost never*) to five (*almost always*), while emotional engagement is rated on a scale from one (*strongly disagree*) to five (*strongly agree*). In addition, we rated emotional engagement on a five-point scale ranging from one (*completely disagree*) to five (*completely agree*). The mean of the 23 items was used in the analysis, calculated the mean scores of the 23 items, with higher scores indicating a high level of school engagement. The Cronbach’s alpha coefficient for the current sample is 0.71.

2.3.3. Deviant peer affiliation

Deviant peer affiliation was measured by using questionnaire adapted by Zhu et al. (2015). The questionnaire comprises 12 items that assess participants indicated the number of close friends who had engaged in 12 types of deviant behaviors, such as cheating and smoking, over the past six months (e.g., “How many of your friends have running away from home?”). The responses were rated on a five-point scale ranging from one (*never*) to five (*six or more*). We calculated the mean scores of the 12 items, with higher scores indicating a high level of deviant peer affiliation. This questionnaire has previously shown adequate reliability and validity in Chinese adolescents (Lin et al., 2022; Tian et al., 2019a; Zhu et al., 2017). The Cronbach’s alpha coefficient for the current sample is 0.88.

2.3.4. Aggressive behavior

The Chinese version of the aggression questionnaire (Su et al., 2017) adapted from the Buss-Warren Aggression Questionnaire to assess aggressive behavior (Maxwell, 2008). The 19-item questionnaire comprises three facets that describe levels of physical aggression (e.g., “I may hit someone if he or she provokes me”), verbal aggression (e.g., “I can’t help getting into arguments when people disagree with me”), and relational aggression (e.g., “I sometimes spread gossip about people I don’t like”) over the past six months. The responses were rated on a five-point scale ranging from one (*not at all*) to five (*absolutely like me*). The mean scores of the 19 items reflect the level of aggressive behavior, with higher scores indicating a higher level of aggression. This questionnaire effectively measures levels of aggressive behavior and has demonstrated high reliability and validity among Chinese adolescents in previous studies (Li et al., 2022; Lin et al., 2020; Lin et al., 2022; Tian et al., 2023). The Cronbach’s alpha coefficient for the current sample is 0.82.

2.4. Analysis strategy

We used SPSS 26.0 and Mplus 8.0 for statistical analyses. The

percentage of missing data was less than 1 %. Mean imputation was used to handle missing data. First, we analyzed the descriptive statistics and bivariate correlations using SPSS 26.0. We also used Harman’s single-factor test to assess the potential common-method bias due to the self-reported answers. Next, we estimated the serial mediation roles of school engagement and deviant peer affiliation using Mplus 8.0 (Muthén & Muthén, 1998–2017) and calculated four fit indices: χ^2 statistic, comparative fit index (CFI) and root mean square error of approximation RMSEA (Hoyle, 2012; Kline, 2011). Models that produced a nonsignificant χ^2 , a CFI above 0.90, and an RMSEA below 0.08 were considered to have an acceptable fit to the data (Hoyle, 2012; Kline, 2011). We used the bootstrap sampling method because it requires no assumptions regarding the shape of the sampling distribution of the estimated effects or standard errors (Liu et al., 2021). We estimated bias-corrected 95 % confidence intervals (95 % CI) using 5000 bootstrapping samples to test the statistical significance of direct and indirect pathways. We considered the effects significant when the 95 % CI did not include zero. We standardized all results. Finally, we controlled age, gender, and family per capita monthly income (ordinal variable) as covariates in the serial mediation analysis.

3. Results

3.1. Descriptive statistics

Table 2 reports the means, standard deviations, and correlations of the variables of interest. The results indicate that relative deprivation is positively associated with deviant peer affiliation and aggressive behavior and negatively associated with school engagement. Moreover, school engagement shows negative associations with deviant peer affiliation and aggressive behavior ($p < 0.01$, 0.05, respectively), and deviant peer affiliation is positively associated with aggressive behavior ($p < 0.001$).

We assessed common-method bias using Harman’s single-factor test. The null hypothesis that single-factor underlies participants’ scores was rejected based on the threshold of 40 % total variance being extracted by any single factor (Podsakoff et al., 2003). The results show that the 15 eigenvalues were greater than 1, and the largest variance contributed by any single factor was 15.93 %.

3.2. Mediating roles of school engagement and deviant peer affiliation

After controlling for covariates (gender, age, family income), we used the bootstrap procedure to test the significance of the serial mediation model. The model reveals a good fit to the data: ($\chi^2 = 1.608$, $df = 1$, CFI = 0.998, TLI = 0.977, RMSEA = 0.023). Fig. 1 presents the direct effects in the model, while Table 3 summarizes the model results, including direct effects at the top and indirect effects at the bottom of the table. Relative deprivation is significantly associated with aggressive behavior ($b = 0.198$, $p < 0.001$). Relative deprivation is significantly associated with school engagement ($b = -0.253$, $p < 0.001$), but the association between school engagement and aggressive behavior is not significant ($b = -0.007$, $p > 0.05$). In addition, relative deprivation is significantly associated with deviant peer affiliation ($b = 0.137$, $p < 0.001$), which is associated with aggressive behavior ($b = 0.277$, $p < 0.001$). Furthermore, school engagement is significantly associated with deviant peer affiliation ($b = -0.105$, $p < 0.01$).

As shown in Table 3, bootstrapping analyses suggest that the mediating effect of school engagement in the association between relative deprivation and aggressive behavior is not significant (indirect effects = -0.002, $p > 0.05$). These indirect results are inconsistent with H1. However, the mediating impact of deviant peer affiliation (H2) and serial mediating effect (H3) in the association between relative deprivation and aggressive behavior are significant (indirect effects = 0.038, 0.007, respectively; $p < 0.001$).

Table 2

Summary of means, standard deviations, correlations of variables of interest (N = 1153).

Variables	M	SD	1	2	3	4	5	6	7
1. Gender	0.48	0.50	1						
2. Age	14.76	1.64	−0.06	1					
3. Income	4.43	2.50	−0.028	−0.28**	1				
4. Relative deprivation	2.53	0.76	−0.07*	0.26***	−0.25***	1			
5. School engagement	2.93	0.37	−0.01	−0.29***	0.16**	−0.31***	1		
6. Deviant peer affiliation	1.42	0.55	−0.06*	0.08**	0.06*	0.15***	−0.14**	1	
7. Aggressive behavior	1.91	0.50	−0.06	0.04	0.03	0.22***	−0.08*	0.31***	1

Note. *** $p < 0.001$. ** $p < 0.01$. * $p < 0.05$. Gender was dummy coded such that 0 = male (52.1 %) and 1 = female (47.9 %).

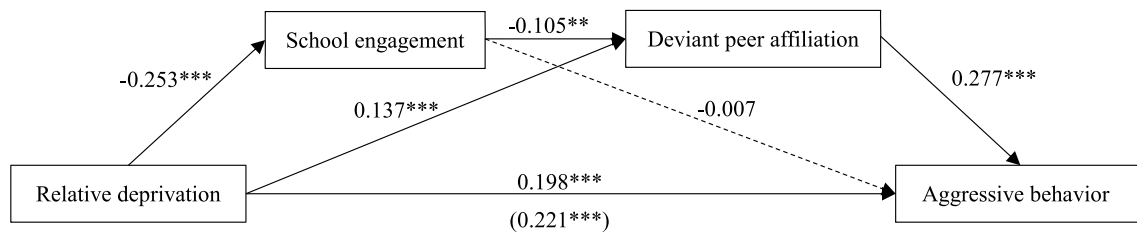


Fig. 1. The serial multiple mediation model. Model estimates are standardized. Dashed lines were insignificant. Without considering the mediating effects of school engagement and deviant peer affiliation, the direct effect of relative deprivation on aggressive behavior is shown in brackets. *** $p < 0.001$; ** $p < 0.01$, * $p < 0.05$.

Table 3

Effects in the serial mediation model (N = 1153).

Pathways	B	SE	b	95 %CI	
Direct effects					
Relative deprivation → school engagement	−0.125	0.016	−0.253***	−0.315	−0.192
Relative deprivation → deviant peer affiliation	0.100	0.023	0.137***	0.074	0.197
School engagement → deviant peer affiliation	−0.156	0.048	−0.105**	−0.167	−0.042
Relative deprivation → aggressive behavior	0.130	0.022	0.198***	0.132	0.262
School engagement → aggressive behavior	−0.009	0.049	0.007	−0.066	0.077
Deviant peer affiliation → aggressive behavior	0.248	0.030	0.277***	0.216	0.337
Indirect effects					
Relative deprivation → school engagement → aggressive behavior	−0.001	0.006	−0.002	−0.020	0.017
Relative deprivation → deviant peer affiliation → aggressive behavior	0.025	0.006	0.038***	0.020	0.058
Relative deprivation → school engagement → deviant peer affiliation → aggressive behavior	0.005	0.002	0.007*	0.003	0.014

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; b = standardized coefficient.

4. Discussion

While several studies have provided evidence regarding the effect of relative deprivation on aggressive behavior (Jiang & Chen, 2019; Martins et al., 2022; Tseng et al., 2013), the possible mechanism remain unclear. In line with ecological systems theory, the current study investigates whether and how relative deprivation affects adolescents' aggressive behavior in China. The mediating role of school engagement is insignificant between relative deprivation and aggressive behavior in adolescents (H1). The results have shown the mediating role of deviant peer affiliation (H2) and the serial mediating of school engagement and deviant peer affiliation (H3) between perceived relative deprivation and adolescents' aggressive behavior.

We found that relative deprivation is significantly positively associated with adolescents' aggressive behavior, consistent with previous

studies (Jiang & Chen, 2019; Kassab et al., 2021; Tian et al., 2023). Personal internal states, cognition of lower social status, and negative emotions contribute to this association (Harenski & Kiehl, 2010; Smith et al., 2012; Smith et al., 2018), increasing the motivation to engage in aggressive behavior to improve social status and reduce negative emotions (Anderson & Carnagey, 2004; Harenski & Kiehl, 2010; Smith et al., 2012). These findings suggest that the development of prevention strategies targeting aggressive behavior in adolescents should consider subjective experiences of relative deprivation. Overall, these findings provide evidence for subsequent analysis and further elucidate the role of microsystems in this relationship.

Previous studies have mainly focused on internal processes or personal variables when examining the relationship between relative deprivation and aggressive behavior, while giving relatively less attention to the role of contexts, which are important for adolescent behavioral development (Greitemeyer & Sagioglou, 2017; Jiang & Chen, 2019; Kassab et al., 2021). This study, based on ecological systems theory, examined school engagement as a mediator in the relationship between relative deprivation and aggressive behavior in adolescents. Though some research shows the role of school engagement in aggressive behavior, the mediating pathway of school engagement is insignificant and inconsistent with H1 in the present study (Irvin, 2012; Konold et al., 2017). There was no direct effect of school engagement on aggressive behavior. However, this finding does not imply that school engagement does not influence aggressive behavior when adolescents perceive relative deprivation. Instead, it may reflect how the school, as a distal factor, influences adolescents' behaviors through the mediation of peer relationships (Lin et al., 2020; Liu et al., 2021). Our result concerning the serial mediation model also supports this explanation and gives evidence of the impact of multiple contexts including both school and peers.

In addition, the role of deviant peer affiliation is consistent with H2 and is a significant mediator for adolescent aggressive behavior when adolescents perceive relative deprivation. This finding shown that deviant peer affiliation as a critical mediator in increasing aggressive behavior due to relative deprivation. Adolescents experience psychological stress, low social status and unfairness when faced with high levels of relative deprivation. As a result, they may seek to release the resulting tensions by affiliating with deviant peers. Hence, adolescents perceiving relative deprivation are more likely to affiliate with deviant peers who have higher autonomy and social status due to being less

restricted by the rules (Callan et al., 2008; Yang et al., 2021). As a result, adolescents may develop aggressive behavior due to deviancy training and repeated peer reinforcement from deviant peers (Bao et al., 2022; Chapple et al., 2014). Similarly, Yang et al. (2021) found that relative deprivation predicted deviant peer affiliation of adolescents, which influences behavior development. Therefore, our findings suggest the crucial role of deviant peer affiliation in the relationship between relative deprivation and aggressive behavior in adolescents.

Finally, the serial mediation of school engagement and deviant peer affiliation in the relationship between relative deprivation and aggressive behavior supports ecological systems theory regarding the dynamic interconnecting with multiple microsystems (Bronfenbrenner, 2005; Darling, 2007; Tian et al., 2019b). These results support H3 and consistent with points of Social Control Theory (Hirschi, 1969) and the Social Development Model (Hawkins & Weis, 1985). Expressly, adolescents who sense relative deprivation may have low motivation to engage in school (Esposito & Villaseñor, 2019; Lee et al., 2022; Nieuwenhuis & Chiang, 2021; Park, 2021). Consequently, low levels of school engagement can weaken prosocial interactions, making it more difficult for adolescents to form new friendships in school, thus reinforcing their tendency to seek affiliation with deviant peers (Bao et al., 2022; Zhu et al., 2015). Conversely, higher levels of school engagement encourage adolescents to align with conventional expectations and increased prosocial interactions within the school environment (Hirschi, 1969; Zhu et al., 2015). This, in turn, affects their likelihood of affiliating with deviant peers, ultimately resulting in varying levels of aggressive behavior. These findings are consistent with theoretical perspectives and highlight the importance of considering the effects of various microsystems in research on relative deprivation.

Specifically, these findings provide evidence that school engagement might have a distal effect on adolescents' aggressive behavior through the proximal of deviant peer affiliation. Adolescence is a developmental stage in which peers' influences are particularly strong; social learning and peer pressure can further contribute to aggressive behavior (Dishion et al., 1996; Jiang, 2023). Previous studies have found that peers have a robustly strong effect on adolescent behavior, while the effect of school is relatively small, and that the distal effect of school on adolescent behavior is mediated through the proximal effect of peers (Jia et al., 2017; Lin et al., 2020; Tian et al., 2019a). Thus, whereas school engagement insignificantly mediated the relationship between relative deprivation and aggressive behavior (as in ecological systems theory), the impact of relative deprivation on aggressive behavior was partially serially mediated by school engagement and deviant peer affiliation.

4.1. Implications

Our study integrates the concept of relative deprivation with ecological systems theory to explore the negative effect of relative deprivation on adolescents and examines the roles of the school and peer microsystems. These conclusions have broad practical implications across various economic backgrounds and suggests that educator may decrease the risk of adolescents' aggressive behavior by intervening in relative deprivation across various contexts.

First, our results highlight the importance of considering adolescents' subjective relative deprivation when educators identify targets for intervention and provide psychological support, rather than relying solely on objective indicators. Considering that the process of social comparison is essential for adolescent development (Bronfenbrenner, 1977; Tian et al., 2023), it is important to guide adolescents through this process to prevent perceptions of deprivation (cognitive relative deprivation) and the associated negative emotions (emotional relative deprivation).

Second, we found that adolescents who perceive relative deprivation may seek affiliation with deviant peers, which also mediates the effect of school engagement on aggressive behavior. Hence, deviant peer affiliation is crucial as a proximal factor. Interventions aimed at reducing

deviant peer affiliation may help mitigate the impact of relative deprivation on aggressive behavior. These results suggest that educators need to pay close attention to adolescents' peer groups, including the number of peers and their behaviors. School-aged adolescents' peers primarily come from school and the community (Jiang, 2023), highlighting the necessity for a multifaceted effort to guide their peer relationships.

Finally, under the influence of relative deprivation, adolescents may avoid school activities. Although school engagement does not significantly impact aggressive behavior directly, adolescents with low school engagement may seek support from deviant peers, leading to higher levels of aggressive behavior. Therefore, promoting school engagement among adolescents may reduce aggressive behavior by lowering deviant peer affiliation. Interventions aimed at increasing attention range and enabling adolescents to engage in school may help adolescents create a better peer group and avoid the aggressive behavior derived from relative deprivation (Xu et al., 2022; Zhang et al., 2021).

4.2. Limitations and Future Directions

Despite its contributions, this study has several limitations. First, though our serial mediation model is based on theory and previous studies, we used a cross-sectional design to delineate the relationship, which limits to infer causal relationships. While peer relationships among school-aged adolescents are significantly influenced by the school, the relationships between different microsystems are interdependent (Neal & Neal, 2013). To overcome this limitation in establishing causality, future studies could employ longitudinal designs or experimental techniques to better clarify the causal patterns within this model. Second, our results revealed the effects of multiple factors and the serial effect accounted for in the proposed model. However, the ecological systems theory emphasizes various microsystems beyond school and peers in the real world. This study only address why and how relative deprivation might lead to adolescent aggression via school engagement and deviant peer affiliation. In addition, other factors, such as parenting (Liu et al., 2022), gender (Chapple et al., 2014), and objective disadvantage (Bookhout et al., 2021), may significantly influence adolescents' behavior and be correlated with relative deprivation. Future studies should explore other factors to clarify the mechanism and extend the relative deprivation theory. Third, the aim of this study is to explain the effect of the microsystem in natural life with reference to education by the ecological systems theory rather than the cognitive process or internal structure of relative deprivation. Previous studies have pointed out that disaffected emotions decrease engagement, influencing the behavior of adolescents (Skinner et al., 2008). Other studies have explored several relevant factors of relative deprivation, such as visual working memory (Zhang et al., 2021). Future studies could explore relative deprivation's cognitive and emotional mechanisms through sub-scales to explain the internal process and address the disadvantage of relative deprivation. Finally, due to all study participants being from China. The five types of social comparison involved in the Adolescents' Relative Deprivation Scale have been shown to effectively reflect the levels of relative deprivation among Chinese adolescents (Tian et al., 2021; Tian et al., 2023). However, it has not yet been verified whether these findings are applicable to adolescents from other cultures. Thus, researchers should consider the limitation when generalizing these results to other cultures.

5. Conclusions

This study enhanced our understanding regarding the serial mediation mechanisms at play in the relationship between relative deprivation and aggressive behavior in adolescents. The findings showed that relative deprivation is a significant risk factor for aggressive behavior, and deviant peer affiliation mediates this relationship. The mediating path between relative deprivation and aggressive behavior via deviant peer affiliation is significant; however, the mediating pathway via school

engagement is not. Moreover, we find that multiple contexts support a serial mediation model. The study's results show that relative deprivation is negatively associated with school engagement, which increases the risk of deviant peer affiliation, resulting in adolescents' aggressive behavior.

CRedit authorship contribution statement

Yunlong Tian: Data curation, Writing – original draft, Visualization, Investigation. **Xun Deng:** Software, Validation, Writing – review & editing. **Wei Tong:** Conceptualization, Supervision. **Wen He:** Conceptualization, Methodology, Software, Project administration.

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Institutional Review Board Statement

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The research presented in this article was approved by the Research Ethics Committee of Guangzhou University (NO. GZHU 2017012).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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