



Growing Minds, Diverging Paths: Psychological *Suzhi* Trajectories and Adolescent Adjustment in China

Qian Nie¹ · Chunyan Yang² · Chun Chen³ · Michael Furlong⁴ · Mei-ki Chan⁵ · Dajun Zhang⁶ · Cheng Guo⁶ · Zhaojun Teng⁶

Received: 31 May 2025 / Accepted: 17 July 2025

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2025

Abstract

Psychological *suzhi* is a culturally rooted construct that emerged from China's quality-oriented educational reform, aiming to promote positive adolescent development. It integrates *cognitive, individuality, and adaptability* qualities, forming a dynamic internal system that supports resilience and mental health in Chinese contexts. Despite its theoretical prominence in Chinese educational discourse, research on its developmental trajectory and long-term implications for adolescent adjustment remains limited. This three-year longitudinal study (six waves) followed 1812 middle school students ($M_{\text{age}} = 12.56$ years, $SD = 0.73$, 51.4% boys) and 2482 high school students ($M_{\text{age}} = 15.43$ years, $SD = 0.60$, 49.6% boys). Latent growth models revealed a general decline in psychological *suzhi* among middle school students and a gradual increase among high school students. Latent class growth models identified four distinct trajectory profiles for each developmental stage—middle school: *top/stable* (15.2%), *high/decrease* (42.9%), *average/decrease* (35.1%), and *low/decrease* (6.8%); high school: *top/increase* (9.5%), *high/increase* (41.9%), *average/increase* (38.5%), and *low/increase* (10.1%). Structural equation modeling showed that adolescents with higher psychological *suzhi* trajectories exhibited better mental health, fewer internalizing and externalizing problems, and stronger academic achievement. These patterns suggest that developmental changes in psychological *suzhi* are meaningfully linked to adolescents' adjustment outcomes in China's current, exam-oriented educational system. This study lays the groundwork for designing stage-specific, trajectory-based interventions to support students' psychological development in Chinese secondary education.

Keywords: Psychological *suzhi* · Developmental trajectory · Mental health · Behavior problems · Academic achievement

Introduction

Psychological *suzhi* (心理素质) is a core indigenous Chinese concept that reflects individuals' fundamental *cognitive, individuality, and adaptability* qualities (Zhang et al., 2000, 2011). It has been consistently associated with positive youth outcomes, including better mental health (e.g., X. Liu et al., 2024; Miao et al., 2024), higher academic achievement (e.g., G. Liu et al., 2020; Nie et al., 2021), and fewer behavioral problems (e.g., S. Luo et al., 2021; X. Wang et al., 2025), underscoring its significance in adolescent positive psychosocial development. The growing body of research on psychological *suzhi* predominantly relies on cross-sectional designs, which limit understanding of its developmental trajectory and its longitudinal associations with adolescent adjustment. To capture the complexities of this relationship, it is essential to adopt a longitudinal approach. Exploring the development trajectories of psychological *suzhi* has potential benefits for

✉ Qian Nie
nieqian450@swu.edu.cn

✉ Zhaojun Teng
tengzj@swu.edu.cn

¹ School of Journalism and Communication, Publishing Research Institute, Southwest University, Chongqing, China

² Department of Counseling, Higher Education, and Special Education, University of Maryland, College Park, MD, USA

³ School of Humanities and Social Science, Chinese University of Hong Kong, Shenzhen, China

⁴ School Mental Health Collaborative, University of California Santa Barbara, Santa Barbara, CA, USA

⁵ Berkeley School of Education, University of California, Berkeley, CA, USA

⁶ Faculty of Psychology, Research Center of Mental Health Education, Southwest University, Chongqing, China

fostering higher levels of *suzhi* among adolescents and developing corresponding intervention strategies. Furthermore, prior research on the association between *suzhi* and adjustment has primarily targeted self-reported variables (e.g., Nie et al., 2018, 2020), neglecting the diversity of developmental trajectories of psychological *suzhi* and its longitudinal associations with multidimensional outcomes across different ecological contexts. This study addresses these gaps by utilizing a three-year, six-wave longitudinal dataset from Chinese adolescents to (a) identify distinct developmental trajectories of psychological *suzhi* using latent class growth modeling (LCGM), and (b) examine its longitudinal associations with multi-informant reports of mental health, behavioral adjustment, and academic outcomes through structural equation modeling (SEM).

Psychological *Suzhi*

Psychological *suzhi* is a widely applied Chinese concept that comprises an integrated collection of positive psychological qualities in Chinese children and adolescents (Nie et al., 2020, 2021; Zhang et al., 2011). In recent years, the Chinese government has emphasized the need to improve education quality, focusing on the relationship between the development of Chinese students and the promotion of psychological *suzhi*. This concept reflects the distinctive strengths of Chinese cultural heritage and educational practices (Zhang & Shao, 2025). As noted by the Ministry of Education of the People's Republic of China (2012), “the overall goal of mental health education is to improve the psychological *suzhi* of all students” (p. 2). Enhancing psychological *suzhi* has become a key goal of education reform in China, supporting students' development and overall well-being.

Psychological *suzhi* is a hierarchical and multidimensional construct comprising three interrelated qualities: *cognitive*, *individuality*, and *adaptability* (Zhang et al., 2011, 2017a, b). *Cognitive* quality is a psychological trait that influences people's evaluation of their life experiences and is directly influenced by their cognitive activity, particularly awareness, metacognition, and associative memory (Zhang et al., 2000). *Individuality* quality refers to how people approach things in their own unique ways, which is reflected in their behavior. This construct is similar to the Western definition of personality, encompassing self-control, persistence, self-regulation, emotional traits, and self-characteristics (Nie et al., 2020, 2021; Zhang et al., 2011). *Adaptability* quality describes a person's capacity to maintain consistency between themselves and their surroundings, even when those surroundings change as they interact with others. It also includes social harmony, stress management, and positive interpersonal relationships.

Although the psychological *suzhi* construct is distinct from those in Western psychology, some components of

psychological *suzhi* share conceptual commonalities with psychological strengths commonly researched in the U.S. and European contexts, such as self-awareness, self-regulation, and autonomy (e.g., Nie et al., 2020, 2021; Yang, 2022). Scholars have also theoretically compared the concept of psychological *suzhi* and *covitality* (Furlong et al., 2022) and found that psychological *suzhi* has similarities with the *covitality* construct developed by Western scholars (e.g., Furlong et al., 2013, 2014). For example, psychological *suzhi* contends that multiple positive psychology components can cluster into a unified subdimension (e.g., Furlong et al., 2014), allowing researchers to examine both the composite scores of constructs and their subdimensions (e.g., Chan et al., 2021). In addition, compared to psychological resilience, psychological *suzhi* both buffers risk factors and contributes to positive development for children (L. Wu et al., 2018), which might be the most significant distinction between psychological *suzhi* and psychological resilience. Psychological *suzhi* has a profound cultural significance within Chinese education contexts (Furlong et al., 2022). For instance, *adaptability* captures the strengths of individuals' abilities to adapt to social environments rather than emphasizing the “*person*” as the change agent, reflecting the value of social harmony in Chinese cultures (Sundararajan, 2020).

The Developmental Trajectory of Psychological *Suzhi*

Current understanding of the longitudinal developmental trajectories of psychological *suzhi* remains limited. Two large-scale, cross-sectional studies conducted in China have examined mean differences across grade levels (L. Wu et al., 2017; Zhang et al., 2017a). Zhang et al. (2017a) reported a clear increasing trend among primary school children, whereas L. Wu et al. (2017) identified inconsistent patterns among adolescents. Specifically, in middle school, the mean score of psychological *suzhi* was significantly higher among 7th graders compared to those in 8th and 9th grades. By contrast, 11th graders exhibited lower mean scores than both 10th and 12th graders, suggesting a U-shaped pattern during high school. While these findings provide insights into grade-level differences, the cross-sectional design—relying on different cohorts assessed at a single time point—limits conclusions regarding intraindividual developmental changes.

Longitudinal studies assess changes within individuals over time, allowing for the examination of developmental trajectories. Such studies are particularly valuable for understanding the intraindividual processes underlying the development of psychological *suzhi* and for informing effective prevention and intervention strategies. To date, only a few longitudinal studies have examined the

developmental trajectories of psychological *suzhi* among Chinese adolescents. For example, a two-year longitudinal study found that adolescents' psychological *suzhi* showed a positive developmental trend (Nie et al., 2021). Most prior research has employed variable-centered approaches, which are limited in their ability to capture heterogeneity in developmental patterns.

Person-centered approaches, in contrast, facilitate the identification of distinct developmental trajectories arising from individual differences (e.g., Bono et al., 2019; Fu et al., 2016; Leung et al., 2018). For instance, Pan et al. (2021) identified heterogeneous trajectories among middle school students, including a *moderate/declining* group (79%) and a *high/increasing* group (21%) in 7th grade, and a *low/stable* group (84%) and a *high/increasing* group (16%) in 8th grade. Because this study followed students for only one year, it was limited in its ability to reveal long-term developmental trends and stability.

Despite emerging longitudinal research, limitations such as short follow-up periods (e.g., one year) and restricted analytic approaches remain (e.g., variable-centered approach). More longitudinal studies are needed to examine the individual differences in the development trajectories of psychological *suzhi*. Such understanding is critical for identifying both typical and atypical developmental patterns and for promoting high-quality education that is responsive to students' diverse developmental needs.

The Influence of Psychological *Suzhi* on Students' Psychosocial and Academic Adjustment

According to diathesis-stress theory (Monroe & Simons, 1991), psychological *suzhi* is an internal psychological resource that helps individuals cope with environmental stress and serves as a protective factor in facing challenges. Psychological *suzhi* functions as a diathesis variable, meaning it can directly predict adjustment outcomes and also act as a protective factor that moderates the effect of environmental stress on adjustment outcomes. The relationship between psychological *suzhi* and the mental health model (X. Q. Wang & Zhang, 2012, 2015) also indicates that psychological *suzhi* strongly predicts adjustment outcomes (e.g., He & Zhang, 2019; Pan et al., 2017; D. Wu et al., 2023; Zhao et al., 2018, 2021). "The psychological *suzhi* of the youth and children is the core of their psychological structure, and the substance of psychological activities (domination role); and mental health is the state layer (surface layer or explicit layer) of psychological structure, and also the reflection of the state (symptom) of psychological *suzhi*" (X. Q. Wang & Zhang, 2012, p. 320). That is psychological *suzhi* underpins and supports the development of positive mental health outcomes. In line with these theoretical frameworks, the development of

psychological *suzhi* could negatively predict depression and anxiety symptoms, behavioral problems, and positively predict self-esteem, life satisfaction, and academic achievement.

For depression and anxiety, it is important to acknowledge that middle and high school students often face mental health challenges (e.g., Tang et al., 2020). These difficulties are common due to the intense pressure of high school and college entrance exams (Nie et al., 2021). The psychological *suzhi* and mental health theoretical model (X. Q. Wang & Zhang, 2012, 2015) emphasizes the importance of psychological *suzhi* as a determinant of mental health outcomes among Chinese students (Zhang, 2012). Previous studies have shown that adolescents with higher psychological *suzhi* are less likely to experience depressive (e.g., Hu & Zhang, 2015; Nie et al., 2020) and anxiety (e.g., Lin et al., 2023; L. Wu et al., 2022) symptoms. For instance, a longitudinal study involving 1151 adolescents found that psychological *suzhi* had a negative association with depressive symptoms at both the individual and group levels (Nie et al., 2020). Another study found that higher psychological *suzhi* was linked to lower initial levels and reduced growth of anxiety symptoms in adolescents (Lin et al., 2023).

Additionally, an experimental study demonstrated that individuals with higher psychological *suzhi* displayed lower state anxiety and heart rate in response to stress (L. Wu et al., 2022). A limitation of previous studies was their reliance on self-reports to measure behavioral problems, which could introduce common method bias. To address this limitation, the present study aims to investigate the relationship between internalizing problem behaviors and psychological *suzhi* using alternative sources, such as teachers, to enhance the accuracy and ecological validity of the results.

Mental health indicators encompass not only depressive and anxiety symptoms, but also well-being indicators, such as self-esteem and life satisfaction (Keyes, 2005, 2007; O'Hara et al., 2019). It is essential to recognize that positive and negative indicators are not situated on a single continuum; distinct factors can influence them and can predict various aspects of functioning (Keyes, 2005, 2007). Prior studies have demonstrated that an individual's psychological *suzhi* can positively predict their self-esteem (e.g., G. Liu et al., 2021) and life satisfaction (e.g., Miao et al., 2021). Psychological *suzhi* plays a mediating role in the relationship between contextual variables and mental health outcomes, including life satisfaction (G. Liu et al., 2021; Miao et al., 2021) and problem behaviors (Pan et al., 2017). Moreover, psychological *suzhi* functions as a protective factor in the association between stress and mental health (e.g., H. Wang et al., 2024).

Research shows that adolescents' psychological *suzhi* has a negative relationship with conduct problems, hyperactivity, and peer interaction problems (He & Zhang, 2019) and also predicts conduct problems and hyperactivity one year later (Pan et al., 2017). The link between psychological *suzhi* and behavioral problems aligns with the diathesis-stress theory (Monroe & Simons, 1991; Van Heeringen, 2012), which suggests that interactions between stress experiences and diathesis (e.g., psychological *suzhi*) can predict psychopathology and behavioral problems. For instance, psychological *suzhi* not only mitigated the adverse effects of peer victimization on externalizing problem behaviors (Zhao et al., 2018) but also acted as a mediator in the relationship between peer victimization and suicidal ideations (D. Wu et al., 2023).

The traditional emphasis on academic achievement in Chinese exam-oriented education may be overemphasized. Investigating how psychological *suzhi* can predict academic performance can enhance understanding of the value of implementing quality-oriented education in Chinese schools that prioritize academic success. Psychological *suzhi* can shape students' overall learning skills and adaptive outcomes, which in turn can predict their learning outcomes (e.g., G. Liu et al., 2020; Nie et al., 2021; Zhang et al., 2000). Guided by Bronfenbrenner's bioecological model (Bronfenbrenner & Morris, 2007; Tudge et al., 2022), Nie et al. (2021) conducted a two-year (four-wave) longitudinal study involving 3587 seventh and tenth graders. They identified four different subgroups of academic achievement developmental trajectory groups (i.e., *high/positive growth*, *middle/negative growth*, *low/stable*, and *lowest/stable*). Different levels of psychological *suzhi* (especially *cognitive quality*) significantly predicted group differences in academic achievement. Meanwhile, researchers have also found that students' psychological *suzhi* significantly predicted their academic achievement one year later (G. Liu et al., 2020). Further research is needed to explore whether adolescents with different psychological *suzhi* development trajectories show significant differences in academic achievement.

Current Study

Despite growing advocacy for *suzhi* (quality) education, skepticism remains regarding its actual impact on students' development and academic success. Moreover, little is known about the developmental trajectories of psychological *suzhi* and their long-term associations with diverse adjustment outcomes. To address these gaps, the current study sought to clarify the role of psychological *suzhi* in the lives of Chinese adolescents within the context of an exam-driven educational system. Given the centrality of psychological *suzhi* in Chinese educational philosophy and the

developmental pressures faced during middle and high school, this study examined how psychological *suzhi* changes over time and how different developmental patterns relate to adolescent adjustment. Using a three-year longitudinal, multi-informant design, this study examined whether distinct trajectories of psychological *suzhi* could be identified among Chinese adolescents (Research Question 1) and then tested whether these trajectories predicted subsequent adjustment outcomes, including complete mental health, internalizing and externalizing problems, and academic achievement (Research Question 2).

Method

Preregistration

The preregistration for this work, including research questions, design, datasets, and planned analyses, is available at [<https://osf.io/7xb9e>]. The Mplus syntax, results, codebooks, and related analyses of this work are also accessible online at [<https://osf.io/dx9uq/>].

Participants and Procedure

The participants were sourced from the Child and Youth Mental Health Development project, an ongoing longitudinal study in southwest China, including regions such as Sichuan, Yunnan, and Chongqing (see Nie et al., 2024 for more details). This work spans six waves from 2018 to 2021 (Time 1 [T1] through Time 6 [T6]). During the initial phase in the fall of 2018, a cluster sampling method was used to select a diverse group of students and their class head teachers from 11 secondary schools across four cities in southwest China. The school selection was also diverse, encompassing public, private, urban, and rural schools, ensuring a representative sample. Surveys were conducted in classrooms each semester, except for the T5 wave, which was completed online due to COVID-19 restrictions. Grades 7 and 10 were invited to participate, with high consent rates—98% of students and 95% of parents. The study included only those who provided both student assent and parental consent.

The participants were 4294 adolescents ($M_{\text{age}} = 14.22$ years, $SD = 1.56$, ranging from 11 to 18; 50.4% boys). There were 1812 students ($M_{\text{age}} = 12.56$ years, $SD = 0.73$, with 51.4% boys) from six middle schools and 2482 students ($M_{\text{age}} = 15.43$ years, $SD = 0.60$, with 49.6% boys) from five high schools. A total of 61.3% of the families resided in rural areas. Moreover, 29.8% of the children were left behind in rural regions while their parents left to work in urban areas. About 20% of fathers and mothers had undergraduate degrees, with more than 50% having a monthly family income of less than 5000 Yuan. The

missing data analysis supported the missing at-random assumption (see Supplementary Information S1 for details).

The project was approved by the human subjects committee of the first author's institution (IRB: H19008). The participation of students involved parental consent and the students' assent. Participation by parents and class teachers was also secured with their consent. School administrators organized the survey and informed students of the study's purpose. Students completed the survey in their classrooms over a period of approximately 30 minutes. School administrators distributed teacher surveys to class head teachers, with each teacher spending about two minutes assessing each student at T1 and T6 in the 2018 and 2021 school years.

Measures

Self-Report Psychological Suzhi

Psychological *suzhi* was measured through a six-wave longitudinal study, with assessment taken at six-month intervals. The Psychological *Suzhi* Questionnaire for adolescents was used, which was developed by Hu et al. (2017). This version is considered the most up-to-date, reliable, and valid tool for assessing psychological *suzhi* in Chinese adolescents. Regarding the factor structure, previous studies suggested that psychological *suzhi* could be represented by a bifactor model, which consists of three specific factors (i.e., *cognitive*, *individuality*, and *adaptability* qualities) and one general factor (i.e., psychological *suzhi*; Hu et al., 2017; Nie et al., 2020). The scale comprises one general factor with 24 items and three specific factors, each represented by a subscale: *Cognitive Quality* (eight items, e.g., "I am skilled at linking old and new knowledge"), *Individuality Quality* (eight items, e.g., "I often remind myself to complete tasks on time"), and *Adaptability Quality* (eight items, e.g., "I adapt well to my current environment and fit in with social groups"). Responses are recorded on a five-point scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). The current study examines psychological *suzhi* as a whole construct, considering its potential unique role in Chinese culture. More information about the subdimensions, components, and items of the Psychological *Suzhi* Questionnaire is presented in Supplementary Information S2. Psychological *suzhi* demonstrated good internal consistency across T1 to T6, with McDonald's ω coefficients of 0.96, 0.97, 0.96, 0.96, 0.96, and 0.96, respectively.

Self-Report Psychosocial Adjustment Outcomes

Adolescents were assessed for psychosocial adjustment outcomes twice: at baseline (T1) and three years later (T6). The variables assessed included self-esteem (Rosenberg et al., 1995; Tian, 2006), life satisfaction (e.g., Diener et al., 1985),

depression symptoms (e.g., Chen et al., 2009), and anxiety symptoms (e.g., Shek, 1993). More details about these measures can be found in Supplementary Information S3.

Teacher-Report Internalizing and Externalizing Problems

The teacher rated every student's internalizing and externalizing problems using the *Strengths and Difficulties Questionnaire* (SDQ; Goodman et al., 2010; S. Liu et al., 2013), which comprises seven internalizing and eight externalizing problems (see Supplementary Information S3 for details). Responses were recorded on a three-point scale (1 = *not agree*, 2 = *agree*, 3 = *totally agree*). The teacher rated each student's SDQ at the baseline (T1) and three years later (T6).

Teacher-Report and Self-Report Academic Achievement

In the Chinese education system, subjects like Chinese, Mathematics, and English are fundamental and are often used to measure students' academic abilities (Nie et al., 2021). Teachers were asked to evaluate students' performance in *Chinese, Mathematics, and English*. Besides, students also self-rated their academic achievement using the same approaches. The evaluations were made using a five-point scale, ranging from 1 (*very poor*) to 5 (*excellent*). Academic achievement was also measured both in T1 and T6 (see Supplementary Information S3 for details). Due to the high correlation between self-reported achievement and teacher-reported achievement, this study combined them by averaging their scores to gain more reliable results (e.g., Nie et al., 2024).

Covariates

Previous research has demonstrated that demographic characteristics such as age (L. Wu et al., 2017), sex (Zhang et al., 2017a), and family socioeconomic status (Nguyen et al., 2020) may have an impact on students' psychological *suzhi*. The self-report demographic information measured at T1 included the participants' age, sex (1 = *boy*, 0 = *girl*), the educational level of their parents (ranging from 1 representing *primary school education* to 5 representing *graduate degree*), family monthly economic incomes (ranging from 0 representing less than 3000 ¥ to 5 representing more than 20000 ¥). The *z-scores* of parents' educational levels and family monthly incomes were used as a socioeconomic index (SES). In the principal component analysis (Vyas & Kumaranayake, 2006), the factor loadings for the father's educational level, the mother's educational level, and family income were 0.872, 0.866, and 0.649, respectively. The first principal component had an eigenvalue of 1.983. In this study, SES was calculated as follows: SES =

$(0.872 \times z\text{-score of father's education level} + 0.866 \times z\text{-score of mother's education level} + 0.649 \times z\text{-score of family income})/1.933$. Higher scores indicate a higher SES, which reflects the family's economic and educational status.

Data Analysis Plan

First, missing data analysis was conducted on the datasets (see Supplementary Information S1). Second, longitudinal measurement invariance of psychological *suzhi* was assessed across six waves (see Table S1). The results suggested psychological *suzhi* could pass the strong invariance ($\Delta\text{CFI} < 0.01$). Third, descriptive statistics and correlations among the study variables were presented. Research has indicated that while psychological *suzhi* in Chinese adolescents is measured similarly, there are mean differences in psychological *suzhi* between middle and high school students (L. Wu et al., 2017). Psychological *suzhi* exhibits distinct growth trajectories at the middle and high school stages. To delineate groups of psychological *suzhi* among these student populations, a series of unconditional latent class growth models (LCGMs) were conducted—models that do not include covariates—with varying numbers of latent classes. The LCGM approach identified distinct groups based on individual patterns of final status and growth in psychological *suzhi* from the first to the sixth time point (2018–2021). The optimal unconditional LCGM solution was selected based on comparative model evaluations.

To determine whether class membership was associated with adjustment outcomes at T6, Structural Equation Modeling (SEM) was used to examine the impact of class membership on T6 adjustment outcomes. Age, sex, SES, and T1 adjustment variables were included as covariates. Additionally, four dummy variables (e.g., 1 = *top*, 0 = *others*) were created to represent class membership. T6 adjustment variables were treated as outcomes in these SEM analyses, with the dummy variables as model predictors. Due to multiple testing for predictors, the significant *p*-values were adjusted by the false discovery rate (Storey, 2003).

All LCGMs were conducted using Mplus 8.40. Given the lack of evidence that attrition was related to psychological *suzhi* and adjustment outcomes (see Supplementary Information S1), the standard missing-at-random approach was used for the current datasets. Model parameters were estimated using full-information maximum likelihood estimation with robust standard errors to account for nonnormality. The goodness of fit for the LCGMs was assessed based on: (a) the lowest scores on the Bayesian Information Criterion (BIC) and the Sample-Size Adjusted Bayesian Information Criterion (SSABIC); (b) entropy values; and (c) a minimum class proportion exceeding 3%

(e.g., Masyn, 2013). The SEM was evaluated using five indicators: the χ^2 test, Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) (Hu & Bentler, 1999).

Results

Descriptive Statistics and Correlations

Table 1 presents the means and standard deviations among the main variables. Middle school students consistently reported higher levels of psychological *suzhi* from T1 to T5 than high school students (except for T6). Additionally, at both T1 and T6, middle school students reported higher levels of well-being (e.g., life satisfaction, self-esteem) and academic achievement, alongside fewer mental health problems (e.g., depressive and anxiety symptoms) than high school students. Teachers reported higher externalizing problems in middle school students than in high school students at T1 and T6.

Table 2 presents the *zero-order* correlations among the main study variables. Psychological *suzhi* was positively correlated with self-esteem, life satisfaction, and academic achievement for both middle school students and high school students. Psychological *suzhi* was negatively correlated with depressive symptoms, anxiety symptoms, and behavior problems (except for externalizing problems).

Research Question 1: Growth Trajectories of Psychological *Suzhi*

Psychological *Suzhi* Growth Trajectories

The goodness-of-fit indices for four latent growth curve models (LGC) patterns—linear, quadratic, linear + quadratic, and free-time were presented. The results indicated that the freely estimated LGC provided the best overall fit for middle and high school student samples (see Table S2). For middle school students, psychological *suzhi* declined significantly ($\text{slope} = -0.206, p < 0.001$), whereas it increased for high school students ($\text{slope} = 0.132, p < 0.001$) (see Fig. 1). Middle school students have a higher intercept (initial value) of psychological *suzhi* than high school students. The significant variances in the intercepts and slopes suggest the presence of heterogeneities in the growth trajectories of psychological *suzhi*.

Psychological *Suzhi* Growth Trajectories Heterogeneity

The Latent Class Growth Models (LCGMs) were explored to identify the growth trajectories of psychological *suzhi*,

Table 1 Sample characteristics and mean difference among middle and high school students

Variables	Sample size			Total sample		Middle school		High school		<i>p</i> -value	Cohen's <i>d</i>
	<i>n</i> _{total}	<i>n</i> _{middle}	<i>n</i> _{high}	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Covariates											
Sex at T1	4294	1812	2482	—	—	—	—	—	—		
Age at T1	4294	1812	2482	14.22	1.56	12.56	0.73	15.43	0.60	< 0.001	−4.35
SES at T1	3909	1681	2228	0.00	1.00	0.08	1.02	−0.06	0.98	< 0.001	0.15
Psychological <i>suzhi</i>											
T1	3647	1419	2228	3.59	0.72	3.83	0.72	3.44	0.67	< 0.001	0.57
T2	3726	1625	2101	3.60	0.74	3.75	0.76	3.49	0.70	< 0.001	0.36
T3	3884	1645	2239	3.68	0.74	3.76	0.77	3.62	0.71	< 0.001	0.19
T4	3833	1624	2209	3.55	0.69	3.58	0.72	3.52	0.66	=0.006	0.09
T5	3595	1591	2004	3.56	0.67	3.59	0.72	3.54	0.63	=0.038	0.07
T6	2990	1415	1575	3.63	0.67	3.63	0.69	3.63	0.65	=0.993	0.01
Student Self-reported measures											
T1 Self-esteem	3650	1421	2229	2.88	0.59	3.01	0.58	2.80	0.59	< 0.001	0.37
T6 Self-esteem	2993	1418	1575	2.91	0.58	2.92	0.58	2.91	0.57	= 0.528	0.02
T1 Life satisfaction	3647	1420	2227	3.31	0.93	3.55	0.91	3.15	0.91	< 0.001	0.44
T6 Life satisfaction	2993	1418	1575	3.29	0.89	3.40	0.89	3.20	0.88	< 0.001	0.23
T1 Depression symptoms	3558	1371	2187	1.01	0.58	0.89	0.58	1.08	0.57	< 0.001	−0.34
T6 Depression symptoms	2994	1418	1576	0.97	0.56	0.95	0.58	0.99	0.55	=0.022	−0.08
T1 Anxiety symptoms	3646	1415	2231	2.19	0.54	2.00	0.53	2.31	0.51	< 0.001	−0.61
T6 Anxiety symptoms	2967	1400	1567	2.19	0.56	2.14	0.58	2.24	0.54	< 0.001	−0.18
T1 Achievement (S) ^a	3658	1424	2234	2.79	0.78	3.13	0.76	2.58	0.72	< 0.001	0.76
T6 Achievement (S)	2971	1402	1569	2.76	0.74	2.81	0.78	2.72	0.70	< 0.001	0.12
Teacher-reported measures											
T1 Internalizing Problems	3620	1395	2225	1.22	0.28	1.18	0.26	1.24	0.30	< 0.001	−0.19
T6 Internalizing problems	3335	1522	1813	1.21	0.32	1.23	0.38	1.19	0.26	< 0.001	0.12
T1 Externalizing Problems	3620	1395	2225	1.28	0.34	1.31	0.36	1.27	0.33	< 0.001	0.12
T6 Externalizing problems	3335	1522	1813	1.22	0.33	1.28	0.39	1.17	0.25	< 0.001	0.37
T1 Achievement (T) ^b	3535	1339	2196	3.02	0.89	3.05	0.98	3.00	0.82	=0.089	0.06
T6 Achievement (T)	3292	1526	1766	3.13	0.95	2.98	1.02	3.27	0.86	< 0.001	−0.31

SES socioeconomic status, T1 measured in the autumn semester of 2018, T2 measured in the spring semester of 2019, T3 measured in the autumn semester of 2019, T4 measured in the spring semester of 2020, T5 measured in the autumn semester of 2020, T6 measured in the spring semester of 2021

^aSelf-reported achievement

^bTeacher reported achievement

Table 2 Zero-order correlations among main variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. T1_SZ	-	.55**	.49**	.47**	.46**	.44**	.61**	.40**	.58**	.28**	-.44**	-.29**	-.53**	-.37**	-.06**	-.09**	-.07**	-.08**	.26**	.17**
2. T2_SZ	.50**	-	.56**	.49**	.48**	.47**	.48**	.43**	.35**	.31**	-.39**	-.32**	-.44**	-.40**	-.09**	-.07**	-.06**	-.04	.15**	.11**
3. T3_SZ	.43**	.53**	-	.62**	.57**	.55**	.43**	.49**	.32**	.37**	-.38**	-.38**	-.44**	-.47**	-.09**	-.13**	-0.03	-.11**	.13**	.13**
4. T4_SZ	.40**	.51**	.56**	-	.64**	.56**	.41**	.51**	.29**	.40**	-.37**	-.43**	-.41**	-.52**	-.08**	-.07**	-.05*	-.10**	.17**	.16**
5. T5_SZ	.42**	.53**	.55**	.69**	-	.60**	.38**	.53**	.30**	.41**	-.35**	-.44**	-.39**	-.52**	-.06**	-.08**	-.06*	-.09**	.15**	.17**
6. T6_SZ	.43**	.48**	.52**	.58**	.64**	-	.35**	.63**	.28**	.54**	-.29**	-.54**	-.36**	-.63**	-.08**	-.09**	-.04	-.10**	.16**	.24**
7. T1_SE	.61**	.41**	.38**	.36**	.36**	.36**	-	.51**	.52**	.29**	-.69**	-.40**	-.72**	-.45**	-.10**	-.08**	-.03	-.04	.22**	.13**
8. T6_SE	.33**	.40**	.41**	.47**	.53**	.66**	.44**	-	.32**	.60**	-.40**	-.70**	-.47**	-.78**	-.08**	-.09**	-.02	-.10**	.19**	.24**
9. T1_LS	.54**	.30**	.27**	.24**	.23**	.24**	.50**	.24**	-	.35**	-.43**	-.26**	-.51**	-.31**	-.02	-.06*	.01	-.06*	.14**	.13**
10. T6_LS	.25**	.30**	.33**	.38**	.44**	.56**	.31**	.60**	.34**	-	-.30**	-.53**	-.37**	-.59**	-.07**	-.09**	-.05*	-.11**	.12**	.20**
11. T1_DP	-.47**	-.36**	-.35**	-.36**	-.34**	-.36**	-.71**	-.40**	-.40**	-.34**	-	.48**	.78**	.47**	.15**	.12**	.10**	.08**	-.16**	-.07**
12. T6_DP	-.24**	-.30**	-.36**	-.36**	-.43**	-.52**	-.34**	-.73**	-.21**	-.52**	.42**	-	.45**	.79**	.08**	.09**	.04	.11**	-.11**	-.18**
13. T1_AN	-.56**	-.40**	-.41**	-.36**	-.36**	-.36**	-.71**	-.39**	-.47**	-.30**	.77**	.38**	-	.52**	.12**	.12**	.07**	.06*	-.18**	-.08**
14. T6_AN	-.29**	-.40**	-.40**	-.46**	-.50**	-.59**	-.37**	-.78**	-.22**	-.56**	.43**	.79**	.44**	-	.10**	.11**	.04	.10**	-.16**	-.21**
15. T1_IN	-.06*	-.11**	-.07*	-.08**	-.07*	-.10**	-.10**	-.07*	-.05	-.04	.15**	.03	.10**	.03	-	.09**	.54**	.06*	-.08**	-.09**
16. T6_IN	-.14**	-.09**	-.14**	-.12**	-.12**	-.09**	-.10**	-.12**	-.11**	-.07**	.13**	.14**	.15**	.14**	.08**	-	.03	.39**	.01	-.16**
17. T1_EX	-.011	-.09**	-.030	-.07*	-.08**	-.052	-.09**	-.07*	.01	-.07*	.11**	.04	.05	.01	.29**	.019	-	.20**	-.20**	-.12**
18. T6_EX	-.09**	-.06*	-.11**	-.13**	-.16**	-.10**	-.09**	-.12**	-.09**	-.08**	.13**	.14**	.10**	.12**	.03	.69**	.26**	-	-.08**	-.22**
19. T1_AA	.22**	.19**	.11**	.19**	.15**	.15**	.28**	.20**	.07**	.12**	-.19**	-.10**	-.19**	-.10**	-.17**	-.01	-.39**	-.12**	-	.41**
20. T6_AA	.08**	.20**	.13**	.24**	.23**	.24**	.20**	.27**	-.03	.16**	-.13**	-.16**	-.10**	-.17**	-.13**	-.01	-.31**	-.17**	.62**	-

T1_SZ-T6_SZ, psychological *suzhi* at time 1 to psychological *suzhi* at time 6. *T1_SE-T6_SE*, self-esteem at time 1 and self-esteem at time 6. *T1_LS-T6_LS*, life satisfaction at time 1 to life satisfaction at time 6. *T1_DP-T6_DP*, depressive symptoms at time 1 to depressive symptoms at time 6. *T1_AN-T6_AN*, anxiety symptoms at time 1 to anxiety symptoms at time 6. *T1_IN-T6_IN*, internalizing problems at time 1 and time 6. *T1_EX-T6_EX*, externalizing problems at time 1 and time 6. *T1_GPA-T6_GPA*, achievement (averaged by self-reported and teacher-rated GPA) at time 1 and time 6. Values above the diagonal (blue) represent the correlations in the sample of middle school students; values below the diagonal (yellow) represent the correlations in the sample of high school students.

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

Values in bold represent non-significant values.

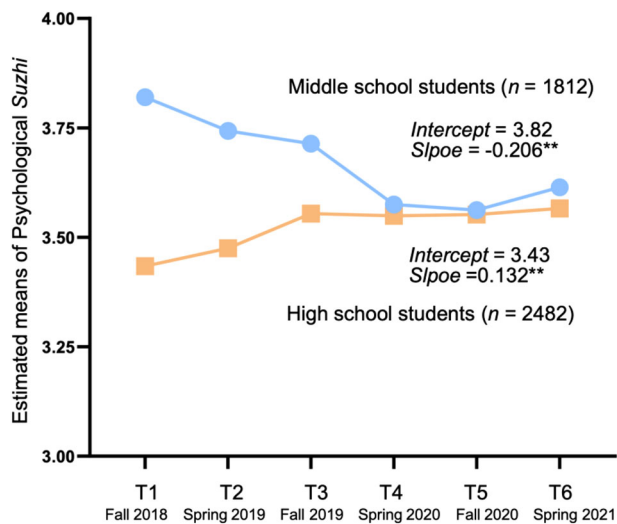


Fig. 1 Overall Developmental Trajectories of Psychological Suzhi in Middle and High School Students. T1–T6 means measure from time 1 to time 6 (fall semester 2018 to spring semester 2021)

considering solutions ranging from two to five classes. The model fit statistics for each solution are detailed in Table 3. The estimated LCGMs with a four-class solution, estimated freely, demonstrated the best overall fit for middle and high school students, as indicated by the lowest BIC, SSABIC, and Entropy values. The five-class solution was deemed less suitable because its smallest group proportion was less than

1%. Consequently, the four-class solution was selected to represent the psychological *suzhi* trajectories for middle and high school students.

Figure 2a delineates four distinct *suzhi* trajectory classes for the middle school sample. First, one class representing *suzhi* (15.2%) exhibited the highest initial intercept ($b = 4.434$, $p < 0.001$) and a nonsignificant positive slope ($b = 0.102$, $p = 0.135$), indicating stable and the highest mean *suzhi* scores over three years. This class is labeled as the *top/stable* trajectory. Second, another class (42.9%) showed a high initial intercept ($b = 3.979$, $p < 0.001$) and a significant negative slope ($b = -0.225$, $p < 0.001$), starting with higher *suzhi* scores than average and exhibiting a slight decrease. This class is labeled as a *high/decrease* trajectory. Third, a class (35.1%) with mean scores around the average is labeled as the *average/decrease* group, characterized by a significant initial intercept ($b = 3.494$, $p < 0.001$) and a negative slope ($b = -0.279$, $p < 0.001$). Lastly, the class with the lowest *suzhi* scores (6.8%) demonstrated the lowest initial intercept ($b = 3.021$, $p < 0.001$) and a significant negative slope ($b = -0.427$, $p = 0.003$) and is labeled as the *low/decrease* class.

Figure 2b delineates four distinct *suzhi* trajectories for the high school student sample. First, one *suzhi* class (9.5%) exhibited the highest initial intercept ($b = 4.159$, $p < 0.001$), coupled with a significant positive slope ($b = 0.354$, $p < 0.001$), indicating the highest mean *suzhi* scores with an

Table 3 Fit Indices of Latent Class Growth Models (LCGMs) for Psychological Suzhi

Statistics pattern	Two classes			Three classes			Four classes			Five classes						
	BIC	aBIC	Entropy	LRT-p	BIC	aBIC	Entropy	LRT-p	BIC	aBIC	Entropy	LRT-p	BIC	aBIC	Entropy	LRT-p
Middle school students' sample (n = 1814)																
Linear	18,446	18,431	0.740	<0.001	17,643	17,598	0.774	<0.001	17,362	17,308	0.746	0.054	17,269	17,205	0.721	0.002
Quadratic	18,508	18,473	0.739	<0.001	17,704	17,660	0.772	<0.001	17,437	17,383	0.741	0.028	17,351	17,288	0.722	0.002
Linear + Quadratic	18,449	18,408	0.740	<0.001	17,605	17,551	0.778	<0.001	17,310	17,243	0.759	0.103	17,219	17,140	0.725	0.168
Free estimate	18,443	18,383	0.742	<0.001	17,608	17,525	0.780	<0.001	17,320	17,215	0.763	0.063	17,276	17,148	0.800	0.585
High school students' sample (n = 2186)																
Linear	22,262	22,227	0.727	<0.001	21,215	21,171	0.771	<0.001	20,800	20,746	0.748	<0.001	20,728	20,644	0.773	0.561
Quadratic	22,278	22,243	0.727	<0.001	21,239	21,194	0.770	<0.001	20,829	20,775	0.747	<0.001	20,771	20,708	0.708	0.555
Linear + Quadratic	22,254	22,212	0.729	<0.001	21,197	21,143	0.775	<0.001	20,775	20,708	0.754	<0.001	20,675	20,595	0.786	0.002
Free estimate	22,202	22,142	0.731	<0.001	21,137	21,055	0.778	<0.001	20,725	20,620	0.759	<0.001	20,697	20,570	0.795	<0.001

BIC Bayesian Information Criterion, *aBIC* The Sample-Size Adjusted Bayesian Information Criterion, *LRT* The Likelihood Ratio Test. Bold indicates the selected model. (1) Linear model: The slope factor loadings were fixed to follow a linear sequence: 0, 1, 2, 3, 4, 5. (2) Quadratic model: The slope factor loadings were set to represent a quadratic trend: 0, 1, 4, 9, 16, 25. (3) Linear + Quadratic model: Two slope factors were included one representing a linear trend (0, 1, 2, 3, 4, 5) and the other a quadratic trend (0, 1, 4, 9, 16, 25). (4) Free-time model: The first and last time points were fixed at -1 and 0, respectively, while the loadings for the intermediate waves (W2 to W5) were freely estimated based on the data

increasing trend. This class is labeled as the *top/increase* trajectory group. Second, another class (41.9%) demonstrated a high initial intercept ($b = 3.699, p < 0.001$) and a significant positive slope ($b = 0.151, p < 0.001$), starting with higher *suzhi* scores than the average and showing a slight increase, which is labeled as a *high/increase* trajectory. Third, a class (38.5%) with mean scores around the average is labeled as the *average/increase* group, characterized by a significant initial intercept ($b = 3.207, p < 0.001$) and a positive slope ($b = 0.132, p < 0.001$). Last, the class with the lowest *suzhi* scores (10.1%) displayed the lowest initial intercept ($b = 2.543, p < 0.001$) and a significant positive slope ($b = 0.213, p = 0.005$) and is labeled as the *low/increase* trajectory group.

Research Question 2: Different Growth Trajectories of Suzhi on Adjustments

Estimated means and standard deviations of psychological *suzhi* and its correlates among the four classes of adolescents, as well as the effect size of the differences in the study variables, can be seen in Tables S3 and S4. The results suggested that middle and high school students and adolescents in the top and high (than average or low) *suzhi* groups had higher adjustment levels in both T1 and T6. Moreover, the results of the T1 predictors of *suzhi* class membership are presented in Supplementary Information S4 and Supplementary Figures S1, S2.

Figure 3 suggests the SEM results of class membership on adjustment outcomes for middle school students. The model (refer to *low/decrease suzhi* class) suggested good model fits for the middle school students' sample, $\chi^2 = 121.61, df = 42, p < 0.001, CFI = 0.987, TLI = 0.964, RMSEA = 0.032, 95\% CI [0.026, 0.039], SRMR = 0.022$.

After controlling the covariates (age, sex and SES) and T1 adjustments (i.e., self-esteem, life satisfaction, depressive symptoms, anxiety symptoms, internalizing and externalizing problems, and academic achievement), the results suggested, compared to *low/decrease* trajectory, middle school students being in *average/decrease* trajectory was positively linked to T6 self-esteem ($\beta = 0.26, p < 0.001, \text{adjust } p < 0.001$), life satisfaction ($\beta = 0.16, p = 0.003, \text{adjust } p = 0.008$), and academic achievement ($\beta = 0.16, p = 0.001, \text{adjust } p = 0.003$), and negatively linked to T6 depressive symptoms ($\beta = -0.17, p < 0.001, \text{adjust } p < 0.001$), anxiety symptoms ($\beta = -0.22, p < 0.001, \text{adjust } p < 0.001$) and internalizing problems ($\beta = -0.20, p = 0.008, \text{adjust } p < 0.015$). When referenced to *average/decrease* trajectory, the SEM showed the same model fits and being in *high/decrease* trajectory was positively linked to T6 self-esteem ($\beta = 0.26, p < 0.001, \text{adjust } p < 0.001$), life satisfaction ($\beta = 0.19, p < 0.001, \text{adjust } p < 0.001$), and negatively linked to T6 depressive symptoms ($\beta = -0.23, p < 0.001, \text{adjust } p < 0.001$), T6 anxiety symptoms

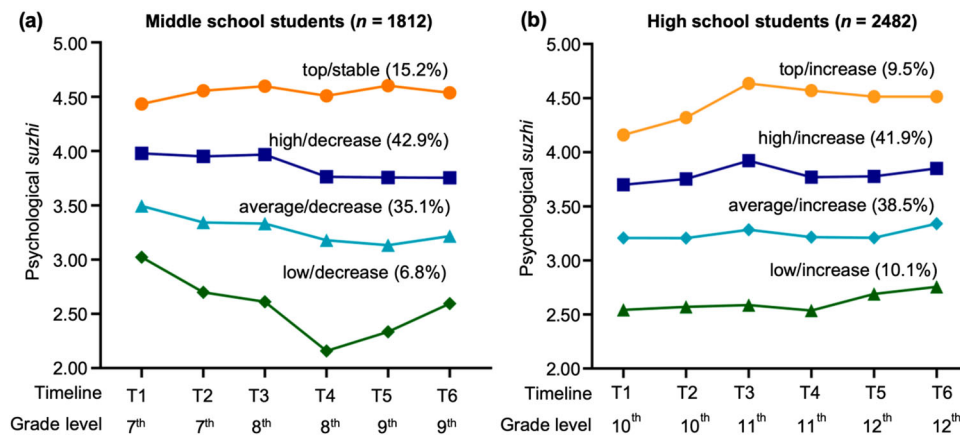


Fig. 2 Estimated Means for Latent Trajectories of Psychological Suzhi in Middle and High School Students. T1-T6 means measure from time 1 to time 6 (fall semester 2018 to spring semester 2021). **a** Four trajectories of psychological *suzhi* for middle school students: *top/stable* (15.2%), *high/decrease* (42.9%), *average/decrease* (35.1%), and *low/decrease* (6.8%). **b** Four trajectories of psychological *suzhi* for high school students: *top/increase* (9.5%), *high/increase* (41.9%), *average/increase* (38.5%), and *low/increase* (10.1%)

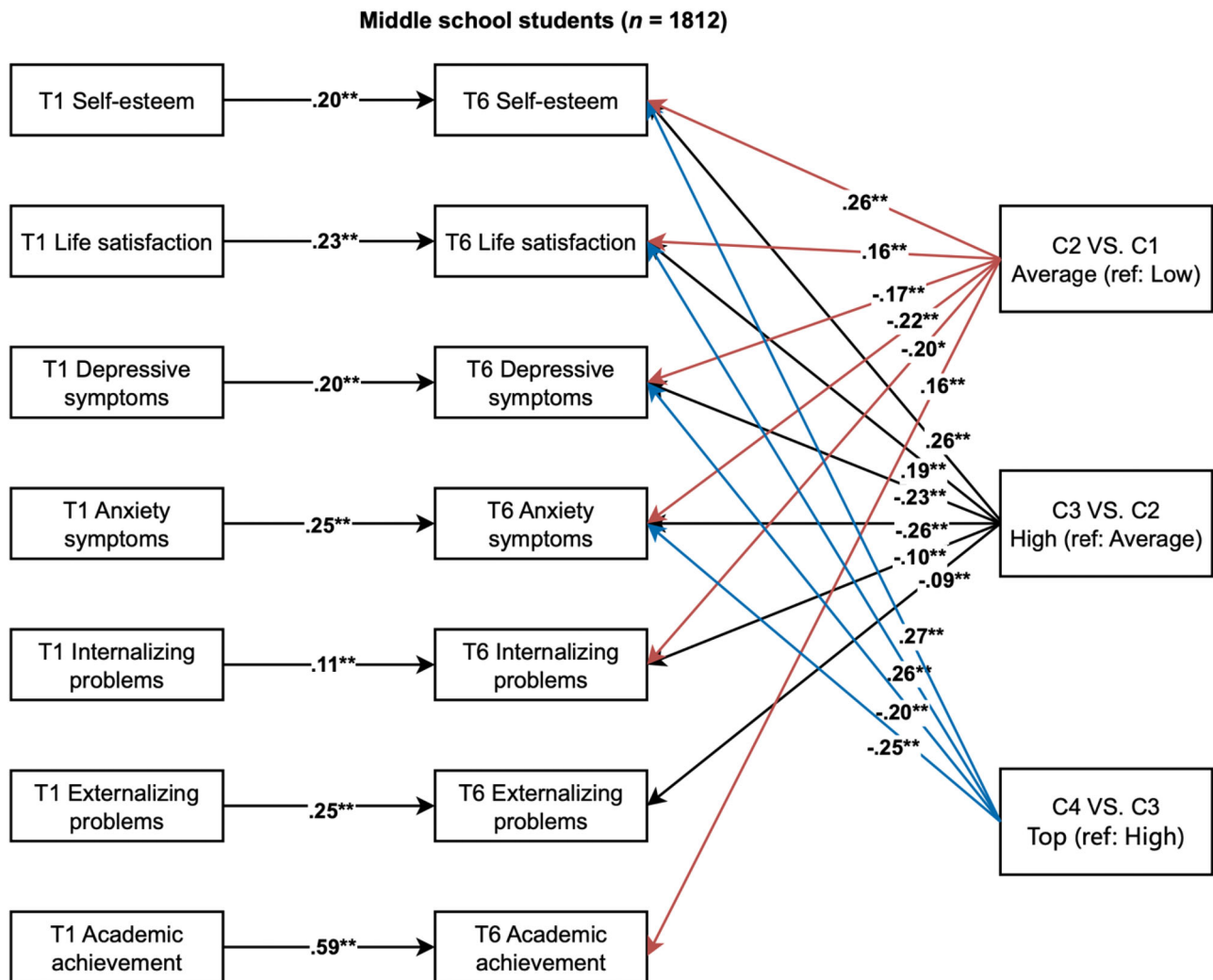


Fig. 3 Estimates SEM of Class Membership on Adjustment Outcomes Among Middle School Students. T1 time 1 (baseline), T6 time 6, C1 *low/decrease suzhi*, C2 *average/decrease suzhi*, C3 *high/decrease suzhi*, C4 *top/stable suzhi*. All estimated effects are the standardized

coefficients. The correlations among study variables are not shown. The models included covariates for age, sex (coded as 1 for boy and 0 for girl), and socioeconomic status (SES). * $p < 0.05$. ** $p < 0.01$

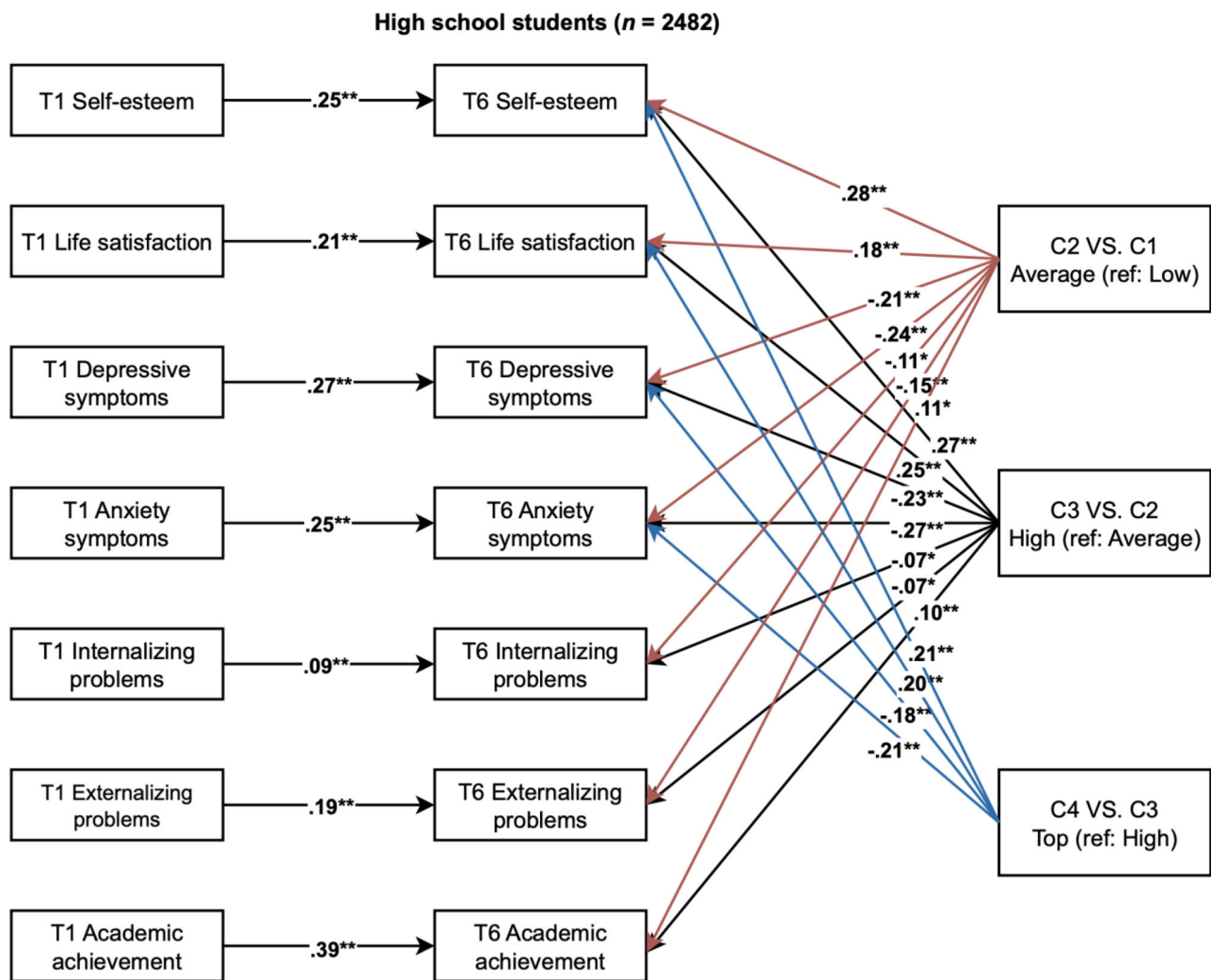


Fig. 4 Estimates SEM of Class Membership on Adjustment Outcomes Among High School Students. T1 time 1 (baseline), T6 time 6, C1 *low/increase sushi*, C2 *average/increase sushi*, C3 *high/increase sushi*, C4 *top/increase sushi*. All estimated effects are the standardized

coefficients. The correlations among study variables are not shown. The models included covariates for age, sex (coded as 1 for boy and 0 for girl), and socioeconomic status (SES). * $p < 0.05$. ** $p < 0.01$

($\beta = -0.26$, $p < 0.001$, adjust $p < 0.001$), T6 internalizing ($\beta = -0.10$, $p < 0.001$, adjust $p < 0.001$) and externalizing problems ($\beta = -0.09$, $p = 0.002$, adjust $p = 0.006$). When referenced to the *high/decrease* trajectory, the SEM showed the same model fits and being in *top/stable* trajectory was positively linked to T6 self-esteem ($\beta = 0.27$, $p < 0.001$, adjust $p < 0.001$), life satisfaction ($\beta = 0.26$, $p < 0.001$, adjust $p < 0.001$), and negatively linked to T6 depressive symptoms ($\beta = -0.20$, $p < 0.001$, adjust $p < 0.001$), anxiety symptoms ($\beta = -0.25$, $p < 0.001$, adjust $p < 0.001$), but not significantly linked to T6 internalizing and externalizing problems or academic achievement.

The SEM model (refer to *low/increase sushi* class) for high school students suggested a good model fit, $\chi^2 = 132.35$, $df = 42$, $p < 0.001$, CFI = 0.983, TLI = 0.955, RMSEA = 0.029, 95% CI = [0.024, 0.035], SRMR = 0.019.

After controlling the covariates (age, sex, and SES) and T1 adjustments (i.e., self-esteem, life satisfaction, depressive symptoms, anxiety symptoms, internalizing and externalizing problems, and academic achievement), the results suggested (see Fig. 4), compared to *low/increase* trajectory, high school students being in *average/increase* trajectory was positively linked to T6 self-esteem ($\beta = 0.28$, $p < 0.001$, adjust $p < 0.001$), life satisfaction ($\beta = 0.18$, $p < 0.001$, adjust $p < 0.001$), and academic achievement ($\beta = 0.11$, $p = 0.008$, adjust $p = 0.012$), and negatively linked to T6 depressive symptoms ($\beta = -0.21$, $p < 0.001$, adjust $p < 0.001$), anxiety symptoms ($\beta = -0.24$, $p < 0.001$, adjust $p < 0.001$), internalizing ($\beta = -0.11$, $p = 0.012$, adjust $p = 0.025$) and externalizing problems ($\beta = -0.15$, $p = 0.003$, adjust $p = 0.008$).

While referenced to *average/increase* trajectory, the SEM showed the same model fits and being in *high/*

increase trajectory was positively linked to T6 self-esteem ($\beta = 0.27, p < 0.001, \text{adjust } p < 0.001$), life satisfaction ($\beta = 0.25, p < 0.001, \text{adjust } p < 0.001$), and T6 academic achievement ($\beta = 0.10, p < 0.001, \text{adjust } p < 0.001$), and negatively linked to T6 depressive symptoms ($\beta = -0.23, p < 0.001, \text{adjust } p < 0.001$), anxiety symptoms ($\beta = -0.27, p < 0.001, \text{adjust } p < 0.001$), internalizing ($\beta = -0.07, p = 0.009, \text{adjust } p = 0.024$) and externalizing problems ($\beta = -0.07, p = 0.004, \text{adjust } p = 0.012$). While referencing the *high/increase* trajectory, the SEM showed the same model fits, being in the *top/increase* trajectory was positively linked to T6 self-esteem ($\beta = 0.21, p < 0.001, \text{adjust } p < 0.001$), life satisfaction ($\beta = 0.20, p < 0.001, \text{adjust } p < 0.001$), and negatively linked to T6 depressive symptoms ($\beta = -0.18, p < 0.001, \text{adjust } p < 0.001$) and anxiety symptoms ($\beta = -0.21, p < 0.001, \text{adjust } p < 0.001$), but not significantly linked to T6 internalizing and externalizing problems or academic achievement.

Sensitivity Analyses

The sensitivity analyses were not preregistered, but it is also necessary to further evaluate the current study's findings. First, another missing data analysis method (i.e., MI) was used to conduct LCGMs. The results remained the same as those of FILM and suggested four classes' solutions (see Supplementary Figure S3). Second, to ensure the high or top *suzhi* classes have the same effect as the average as the low *suzhi* group. Supplementary Figures S4, S5 presents the completed SEM models. Third, given that this longitudinal study was conducted during the COVID-19 pandemic, the impact of adolescents' perceptions of COVID-19 (cf. Teng et al., 2021) on the results was examined. The results were consistent with the primary analyses and are illustrated in Supplementary Figures S6 and S7, which include covariates related to perceived impacts of COVID-19.

Discussion

The developmental trajectories of psychological *suzhi* and their longitudinal associations with psychosocial and academic adjustment outcomes have been largely unknown. To address these gaps, this longitudinal study used multi-informant data. It employed both person-centered and variable-centered approaches to investigate the developmental trajectories of psychological *suzhi* among Chinese adolescents, including both middle and high school students, and their associations with their adjustment outcomes. Over the course of three years, this study identified distinct developmental trajectories of psychological *suzhi* among both middle and high school students. Middle school students showed a significant decrease in *suzhi*, while high school

students demonstrated an increasing trajectory. In both middle and high school samples, four ordered classes based on *suzhi* trajectories were found: *low*, *average*, *high*, and *top*. When controlled for various factors and initial baseline adjustments, students being in the *high* and *top suzhi* groups exhibited stronger mental health, fewer behavioral problems, and improved academic performance after three years than those in the *average* and *low suzhi* groups. Adolescents in the *high* and *top suzhi* groups were more likely to demonstrate better academic achievement compared to those in the *low suzhi* group. These results remained consistent even after considering various covariates such as perceived COVID-19 impact, age, sex, and SES.

The Different Developmental Trajectories of Chinese Adolescents' Psychological *Suzhi*

The results revealed a decreasing trend in psychological *suzhi* among middle school students. According to the adolescence theory (Arnett, 1999), middle school students are typically in early adolescence, a period marked by a "storm and stress" phase, during which rapid and unstable psychological changes are more likely to occur than at other ages. As adolescents experience rapid physical and mental development, their psychological and emotional maturity often does not keep pace, making them more susceptible to mental health issues. For high school students, the results show an upward trend in *suzhi*, which refers to their overall psychological quality. This finding is consistent with the maturation effect, suggesting that psychological *suzhi* develops in a progressive pattern, moving from lower to higher levels (Nie et al., 2021).

Four distinct ordered trajectories of psychological *suzhi* for middle and high school students were identified: *top*, *high*, *average*, and *low*. Contrary to previous studies that found only two classes of psychological *suzhi* among middle school students (Pan et al., 2021), this study indicates that the development of *suzhi* is more heterogeneous and complex. Among both middle and high school students, adolescents with *top* levels of psychological *suzhi* exhibited a stable and gradual increase over time. This modest upward trend may be attributed to their initially elevated levels of psychological *suzhi*, a trait that is highly valued in Chinese society. Students with high *suzhi* are more likely to receive positive reinforcement from their social environment, which may further strengthen their psychological *suzhi* and contribute to a positive developmental trajectory (Nie et al., 2021).

Among middle school students, in addition to the *top* group, there is also a decreasing trend of *suzhi* in the three subgroups (i.e., *high/decrease*, *average/decrease*, and *low/decrease*). Middle school students may more frequently experience peer victimization at school, which can deteriorate their development of *suzhi* (e.g., D. Wu et al., 2023; Zhao et al., 2021). Middle school is a period of heightened

mental health problems and significant fluctuations in psychological *suzhi*. While transitioning from primary to middle school involves increasing learning tasks and difficulty (Nie et al., 2024), which might explain a decline in psychological *suzhi* for most middle school students. There were no low/increase classes, indicating that psychological *suzhi* is relatively stable and difficult to improve in low groups. These results implicated that middle school students with low *suzhi* are a priority for future interventions. Addressing the continuing decline of *suzhi* in adolescents and disrupting the negative developmental cycles through targeted quality interventions should be key priorities.

Among high school students, the study observed slow-increasing trajectories for all four classes (i.e., *top*, *high*, *average*, and *low*) of psychological *suzhi*. Although high school students face more difficulties in learning and life events (e.g., stress from the college entrance examination), they exhibit more stable cognitive and affective characteristics. This result implies that gaps in *suzhi* across individuals can further intensify without interventions, particularly for high school students. It should be noted that both middle and high school students significantly decreased *suzhi* from T3 to T4. A potential explanation is that COVID-19 had a substantial stress impact on psychological *suzhi*, and recovery did not occur immediately.

It is worth noting that the initial score of psychological *suzhi* was higher among middle school students than among high school students, consistent with previous research (e.g., L. Wu et al., 2017). This difference may be attributed to the more intensive academic demands and the stress associated with preparing for the college entrance examination that high school students face (Nie et al., 2024). Middle school students are typically in early adolescence and are within the stage of Chinese compulsory education. Although they are beginning to develop self-awareness, their overall stress levels remain relatively manageable. In contrast, high school students often experience greater academic pressure, increased competition, and heightened uncertainty about their future. At this developmental stage, they are more susceptible to anxiety, self-doubt, and emotional fluctuations, which may negatively affect the development of their overall psychological *suzhi*.

Psychological *Suzhi*'s Longitudinal Effect on Students' Psychosocial and Academic Adjustment

The predicting effect of *suzhi* on three adjustment domains was observed in middle and high school students, suggesting its fundamental significance to adolescents' overall functioning. The results indicated that compared to the *low* psychological *suzhi* trajectory, adolescents in the other three trajectories (*top*, *high*, and *average*) were more likely to report a better complete mental health state, both in terms of

higher well-being and lower psychopathology. The predictive power of *suzhi* for positive and negative mental health indicators, as rated by teachers and students, was corroborated. This finding is consistent with the psychological *suzhi* and mental health theoretical model (X. Q. Wang & Zhang, 2012, 2015; Zhang, 2012), which suggests that psychological *suzhi* serves as a protective factor for robust mental health. Psychological *suzhi* is a relatively stable state-like quality, whereas mental health is a more fluctuating trait-like condition.

Specifically, based on students' and teachers' reports, students in the consistently *top*, *high*, and *average* psychological *suzhi* groups had fewer depression and anxiety symptoms, fewer internalizing problem behaviors, and higher self-esteem and life satisfaction compared to the other groups. This favorable mental health profile aligns with previous empirical research findings (e.g., Lin et al., 2023; Miao et al., 2021; Nie et al., 2020). Individuals with high *suzhi* can make dynamic choices (e.g., tend to benefit and avoid harm) about their environment, selectively accepting its influence and maintaining or facilitating the development and change of their mental health (Zhang et al., 2017b). Even when faced with stressful events, such as relocating from a rural to an urban school due to government policy, they can effectively regulate their psychological state and adapt to the new environment (Nie et al., 2025). Individuals with high *suzhi* may exhibit high self-concept clarity (G. Liu et al., 2017) and are more likely to appraise personal success or failure in a favorable light, thereby experiencing fewer mental health problems (Hu & Zhang, 2015). Conversely, individuals with low psychological *suzhi* may have a pessimistic explanatory style, leading them to negatively attribute adverse life events (e.g., academic distress and interpersonal conflicts) to their own faults, which can result in more negative moods.

Using the *low* and *average* trajectories as references, adolescents in the *high* and *top* trajectories exhibited fewer behavioral problems, consistent with previous theories (e.g., Zhang et al., 2017b) and empirical study results (e.g., He & Zhang, 2019; Pan et al., 2017; Zhao et al., 2018, 2021). Students with high *suzhi* would be able to adjust to the environmental conditions more quickly. As an endogenous factor, *suzhi* can influence an individual's external behavior (e.g., L. Wu et al., 2017). In this study, teachers reported externalizing behaviors observed in the school environment. The reason teacher reports might have high fidelity regarding students' behavioral problems is that Chinese adolescents spend most of their time in school, typically from 7:30 in the morning to 9:30 in the evening. Moreover, given the significant academic stress these students already face, those with low psychological *suzhi* are more likely to exhibit low self-control and persistence, which can lead to classroom problem behaviors (e.g., L. Wu et al., 2017).

Individuals with high *suzhi* tend to have higher self-assurance, feel liked and accepted by others, and have a sense of belonging within their school groups. This better interpersonal adaptation and reduced loneliness make them less prone to problematic behaviors.

Compared to the *low* trajectory of *suzhi*, adolescents in *top*, *high*, and *average* trajectories were likely to demonstrate better academic outcomes. It suggests that a minimal baseline level of *suzhi* is essential for academic success, underscoring the importance of nurturing *suzhi* to enhance academic functioning. In line with previous findings (e.g., G. Liu et al., 2020; Nie et al., 2021), the current study provides evidence of the long-term predictive power of *suzhi* on academic achievement three years later. More specifically, adolescents with high *cognitive quality* scores, particularly in one psychological *suzhi* subdomain, are more likely to perform better on exams and achieve higher scores (Nie et al., 2018, 2020). Similar to the importance of non-cognitive factors and social-emotional skills to academic development suggested in other studies (e.g., Duckworth & Yeager, 2015; Furlong et al., 2013), *suzhi* encompasses psychological qualities (e.g., self-control, self-regulation, and adaptive qualities to establish positive interpersonal relationships) that enhance academic performance directly and indirectly (e.g., Fu et al., 2016).

No significant differences were observed between the *top* and *high* psychological *suzhi* groups in terms of internalizing problems, externalizing problems, or academic achievement among both middle and high school students. Interestingly, while teacher-rated internalizing problems did not significantly differ between the two groups, self-reported mental health—including self-esteem, life satisfaction, depressive and anxiety symptoms—did. This discrepancy may reflect teachers' limited ability to detect subtle emotional distress, particularly among students who appear outwardly well-adjusted. Adolescents may be more sensitive and accurate in reporting their internal experiences (e.g., Cannon et al., 2010). This reminds educators that, compared to *top* psychological *suzhi* groups, adolescents in *high* (but not *top*) trajectories may experience more subtle mental health issues that may be easily overlooked. In addition, the nonsignificant difference in academic achievement between the *high* and *top* psychological *suzhi* trajectory groups may suggest a *ceiling* effect (Garin, 2014; Nie et al., 2021), wherein the promotive impact of psychological *suzhi* on academic development plateaus once a certain threshold is reached. It also serves as a reminder that when adolescents' academic achievement is already high, intensifying examination-oriented educational strategies (e.g., rote learning or over-immersing students in examination tactics) may have limited benefits for their achievement. Instead, cultivating psychological *suzhi* could help high and top students simultaneously maintain a complete mental health state and achieve high academic scores.

Limitations and Future Directions

Although this study employed a multi-informant and longitudinal approach with a large sample of Chinese adolescents, it has some research limitations. This study primarily examined the composite scores for overall psychological *suzhi*, without acknowledging that the structure of *suzhi* can be represented as a bifactor model (e.g., Nie et al., 2018, 2021; L. Wu et al., 2017; Zhang et al., 2017b). In this model, both the general factor of *suzhi* and its subscales may have distinct roles in various types of adjustment. Future research should consider analyzing the developmental trends of different subdimensions of *suzhi* (such as *cognitive*, *individuality*, and *adaptability* quality) and their unique contributions to various adjustment outcomes (e.g., academic versus emotional). Second, this study explored the prediction of psychological *suzhi* on adjustments from a developmental perspective. Future studies could further explore the bidirectional relationship between psychological *suzhi* and adjustment outcomes, such as investigating the cross-lagged relationship at the individual and time levels. Third, because this longitudinal study took place during the COVID-19 pandemic, it is possible that psychological *suzhi* declined due to stress related to the pandemic. Nonetheless, even when considering the perceived impacts of COVID-19 as a covariate in the SEM, the results indicated that adolescents with higher *suzhi* levels demonstrated better adjustment. Finally, this study focused on three years of development, but psychological *suzhi* develops across the lifespan. Future research should follow up in a more long-term manner and provide more comprehensive answers for the development of *suzhi*.

Implications for Educational Practice and Policy

The findings highlight the need to prioritize interventions for students with *low* levels of psychological *suzhi*, as this group showed a declining trajectory and proved more resistant to improvement. The findings also highlight pay attention to adolescents with *high*—but not *top*—levels of psychological *suzhi*, whose mental health difficulties may be less overt yet equally consequential. These findings suggest the need for more differentiated and tiered approaches in school-based psychological support systems.

The observed associations between psychological *suzhi* and adjustment outcomes suggest that psychological *suzhi* may serve as a valuable indicator for universal screening and school-based mental health interventions. The link between *suzhi* and holistic mental health underscores the importance of targeted practices and interventions that foster positive youth development, aligning with current policy initiatives in areas such as positive education, parenting, and instruction (Zhang et al., 2011). These findings carry important policy implications for both schools and families, emphasizing the

need to promote psychological *suzhi* through psychoeducational initiatives, even before students enter middle school. Enhancing awareness and understanding of psychological *suzhi* through professional development and educator training programs is also critical. Investigating the role of key individual factors in student development from the perspective of psychological *suzhi* may offer a uniquely Chinese framework for supporting youth development.

The current findings should reassure concerned parents and educators who think quality-oriented education is superfluous; instead, the findings emphasize the beneficial link between fostering students' psychological *suzhi* and their healthy social, psychological, and academic development. Educators should prioritize not only short-term academic goals but also actively support students' long-term holistic development. In many Chinese schools, academic achievement and social-emotional development are often pursued in isolation (Nie et al., 2021). The concept of psychological *suzhi* serves as a guiding framework in the transition from a narrow focus on academic scores to a more balanced, comprehensive, and quality-oriented educational model (Yang, 2022; Zhang, 2012; Zhang et al., 2000). This study demonstrates how psychological *suzhi* can be used to scientifically evaluate the impact of China's quality-oriented education on students' academic and developmental outcomes.

Conclusion

While it has been theorized that psychological *suzhi* is essential for positive adolescent development, empirical research on its connection to long-term adjustment outcomes and developmental trajectories still requires further exploration. To address these gaps, this three-year longitudinal study identified distinctive psychological *suzhi* trajectories among middle and high school students. For middle school students, four trajectories of psychological *suzhi* were identified: *top/stable* (15.2%), *high/decrease* (42.9%), *average/decrease* (35.1%), and *low/decrease* (6.8%). For high school students, the four trajectories identified were: *top/increase* (9.5%), *high/increase* (41.9%), *average/increase* (38.5%), and *low/increase* (10.1%). The study explored subgroups in *suzhi* development that effectively differentiated and predicted adolescents' adjustment three years later. Adolescents in profiles with relatively high *suzhi* reported better complete mental health, fewer behavioral problems, and better academic achievement three years later. This study offers empirical insights into the role of psychological *suzhi* in fostering positive development and adjustment among Chinese adolescents across diverse developmental and ecological contexts. Understanding these insights is crucial for informing the implementation of quality-oriented educational reform policies and enhancing

educational practices both within schools and among families in China.

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1007/s10964-025-02228-2>.

Acknowledgements We acknowledge the teachers and research assistants of the study who helped with the data collection and input. We also acknowledge and thank the participants who took this longitudinal project.

Authors' Contributions QN conceived the study, collected the data, performed the statistical analysis, interpreted the results, drafted and edited the manuscript; CY edited and helped to revised the manuscript; CC edited and helped to revised the manuscript; MF edited and helped to revised the manuscript; MC helped to revised the manuscript; DZ helped to revised the manuscript; CG collected the data, and helped to revised the manuscript; ZT conceived the study, collected the data, performed the statistical analysis, edited and helped to revised the manuscript. All authors reviewed and approved the final manuscript.

Funding The current study is supported by the Funds for Chongqing Social Science Planning Social Organization Project (Grant No.023SZ01, PI. Qian Nie), Humanities and Social Sciences, Ministry of Education of China (Grant No. 23YJC190017, PI. Qian Nie), and Chongqing Education Science Planning Project (Grant No. K23YY2020028, PI. Qian Nie). This study is also partially supported by the Jacobs Foundation Research Fellowship awarded to Chunyan Yang.

Data Sharing Declaration The Mplus syntax, results, codebooks, and related analyses of this work are also accessible online at [<https://osf.io/dx9uq/>]. Raw data should be addressed to the corresponding authors upon reasonable request.

Compliance with Ethical Standards

Conflict of Interest The authors declare no competing interests.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the Declaration of Helsinki. The study was approved by the Research Project Ethical Review Application Form, Faculty of Psychology, Southwest University (IRB protocol number: H19008).

Informed Consent Parental consent and adolescent assent were obtained from all participants included in the study.

References

- Arnett, J. J. (1999). Adolescent storm and stress reconsidered. *American Psychologist, 54*(5), 317–326. <https://doi.org/10.1037/0003-066X.54.5.317>.
- Bono, G., Froh, J. J., Disabato, D., Blalock, D., McKnight, P., & Bausert, S. (2019). Gratitude's role in adolescent antisocial and prosocial behavior: A 4-year longitudinal investigation. *The Journal of Positive Psychology, 14*(2), 230–243. <https://doi.org/10.1080/17439760.2017.1402078>.
- Bronfenbrenner, U., & Morris, P. A. (2007). The Bioecological model of human development. In W. Damon & R. M. Lerner (Eds.), *Handbook of child psychology* (Vol. 1, pp. 793–828). Wiley.
- Cannon, J. A., Warren, J. S., Nelson, P. L., & Burlingame, G. M. (2010). Change trajectories for the Youth Outcome Questionnaire Self-Report: Identifying youth at risk for treatment failure.

- Journal of Clinical Child & Adolescent Psychology*, 39(3), 289–301. <https://doi.org/10.1080/15374411003691727>.
- Chan, M., Yang, C., Furlong, M. J., Dowdy, E., & Xie, J. S. (2021). Association between social-emotional strengths and school membership: A cross-cultural comparison. *International Journal of School & Educational Psychology*, 9(2), 158–171. <https://doi.org/10.1080/21683603.2019.1677539>.
- Chen, Z. Y., Yang, X. D., & Li, X. Y. (2009). Psychometric features of CES-D in Chinese adolescents. *Chinese Journal of Clinical Psychology*, 17(4), 443–445. (in Chinese).
- Diener, E. D., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment*, 49, 71–75. https://doi.org/10.1207/s15327752jpa4901_13.
- Duckworth, A. L., & Yeager, D. S. (2015). Measurement matters: Assessing personal qualities other than cognitive ability for educational purposes. *Educational Researcher*, 44(4), 237–251. <https://doi.org/10.3102/0013189X15584327>.
- Fu, R., Chen, X., Wang, L., & Yang, F. (2016). Developmental trajectories of academic achievement in Chinese children: Contributions of early social-behavioral functioning. *Journal of Educational Psychology*, 108(7), 1001–1012. <https://doi.org/10.1037/edu0000100>.
- Furlong, M. J., Paz, J. L., Carter, D., Dowdy, E., & Nylund-Gibson, K. (2022). Extending validation of a social-emotional health measure for middle school students. *Contemporary School Psychology*, 27, 92–103. <https://doi.org/10.1007/s40688-022-00411-x>.
- Furlong, M. J., You, S., Renshaw, T. L., O'Malley, M. D., & Rebelez, J. (2013). Preliminary development of the Positive Experiences at School Scale for elementary school children. *Child Indicators Research*, 6(4), 753–775. <https://doi.org/10.1007/s12187-013-9193-7>.
- Furlong, M. J., You, S., Renshaw, T. L., Smith, D. C., & O'Malley, M. D. (2014). Preliminary development and validation of the social and emotional health survey for secondary school students. *Social Indicators Research*, 117(3), 1011–1032. <https://doi.org/10.1007/s11205-013-0373-0>.
- Garin, O. (2014). Ceiling effect. In A. C. Michalos (Ed.), *Encyclopedia of quality of life and well-being research* (pp. 631–633). Springer.
- Goodman, A., Lamping, D. L., & Ploubidis, G. B. (2010). When to use broader internalizing and externalizing subscales instead of the hypothesised five subscales on the Strengths and Difficulties Questionnaire (SDQ): Data from British parents, teachers, and children. *Journal of Abnormal Child Psychology*, 38(8), 1179–1191. <https://doi.org/10.1007/s10802-010-9434-x>.
- He, H., & Zhang, D. (2019). Effects of psychological *suzhi* on problem behaviors among freshmen of middle schools and high schools: the mediating role of loneliness and security. *Journal of Southwest University (Natural Science Edition)* (in Chinese) (2), 46–51. <https://doi.org/10.13718/j.cnki.xdsk.2019.02.007>
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6(1), 1–55. <https://doi.org/10.1080/10705519909540118>.
- Hu, T., & Zhang, D. (2015). The relationship between adolescents' psychological *suzhi* and depression: The mediating effect of self-serving attribution bias. *Journal of Southwest University (Natural Science Edition)*, 41, 104–109. <https://doi.org/10.13718/j.cnki.xdsk.2015.06.013>. (in Chinese).
- Hu, T., Zhang, D., & Cheng, G. (2017). Revision of the Psychological *Suzhi* Questionnaire for Adolescents (simplified version) and the test of the reliability and validity. *Journal of Southwest University (Natural Science Edition)*, 43, 120–126. <https://doi.org/10.13718/j.cnki.xdsk.2017.02.015>. (in Chinese).
- Keyes, C. L. (2005). Mental illness and/or mental health? Investigating axioms of the complete state model of health. *Journal of Consulting and Clinical Psychology*, 73(3), 539–548. <https://doi.org/10.1037/0022-006X.73.3.539>.
- Keyes, C. L. (2007). Promoting and protecting mental health as flourishing: A complementary strategy for improving national mental health. *American Psychologist*, 62(2), 95–108. <https://doi.org/10.1037/0003-066X.62.2.95>.
- Leung, C. Y., Leung, G. M., & Schooling, C. M. (2018). Behavioral problem trajectories and self-esteem changes in relation with adolescent depressive symptoms: A longitudinal study. *Social Psychiatry and Psychiatric Epidemiology*, 53(7), 673–684. <https://doi.org/10.1007/s00127-018-1508-z>.
- Lin, L., Zhao, W., Wu, L., Zhang, D., & Cheng, G. (2023). The relationship between psychological *suzhi* and the trajectory of anxiety in senior high school freshmen during the transition period—Based on the latent growth model. *Journal of Psychological Science*, 46(2), 443–449. (in Chinese).
- Liu, G., Pan, Y., Ma, Y., & Zhang, D. (2021). Mediating effect of psychological *suzhi* on the relationship between perceived social support and self-esteem. *Journal of Health Psychology*, 26(3), 378–389. <https://doi.org/10.1177/1359105318807962>.
- Liu, G., Zhang, D., Pan, Y., Hu, T., He, N., Chen, W., & Wang, Z. (2017). Self-concept clarity and subjective social status as mediators between psychological *suzhi* and social anxiety in Chinese adolescents. *Personality and Individual Differences*, 108, 40–44. <https://doi.org/10.1016/j.paid.2016.11.067>.
- Liu, G., Zhao, Z., & Zhang, D. (2020). Cross-lagged relations between psychological *suzhi* and academic achievement. *Current Psychology*, 39(5), 1496–1504. <https://doi.org/10.1007/s12144-019-00184-2>.
- Liu, S., Chien, Y., Shang, C., Lin, C., Liu, Y., & Gau, S. (2013). Psychometric properties of the Chinese version of the Strengths and Difficulties Questionnaire. *Comprehensive Psychiatry*, 54(6), 720–730. <https://doi.org/10.1016/j.comppsy.2013.01.002>.
- Liu, X., Zeng, J., Zhang, Y., Yi, Z., Chen, S., & Liu, Y. (2024). The relationship between psychological needs frustration and depression among Chinese adolescents: The mediating role of self-esteem and the moderating role of psychological *suzhi*. *Journal of Child and Family Studies*, 33(8), 2527–2539. <https://doi.org/10.1007/s10826-023-02775-x>.
- Luo, S., Liu, Y., & Zhang, D. (2021). Socioeconomic status and young children's problem behaviours—Mediating effects of parenting style and psychological *suzhi*. *Early Child Development and Care*, 191(1), 148–158. <https://doi.org/10.1080/03004430.2019.1608196>.
- Masyn, K. E. (2013). Latent class analysis and finite mixture modeling. In T. D. Little (Ed.), *The Oxford handbook of quantitative methods* (Vol. 2: Statistical Analysis, pp. 551–611). Oxford University Press.
- Ministry of Education of the People's Republic of China. (2012). *Guidelines for mental health education in primary and secondary schools (2012 revision)* [中小学心理健康教育指导纲要(2012年修订)] (Document No. Jiao Ji Yi [2012] No. 15). http://www.moe.gov.cn/srcsite/A06/s3325/201212/t20121211_145679.html
- Miao, H., Sun, H., He, X., Zhang, Z., Nie, Q., & Guo, C. (2021). Perceived social support and life satisfaction among young Chinese adolescents: The mediating effect of psychological *suzhi* and its components. *Current Psychology*, 40(12), 6164–6174. <https://doi.org/10.1007/s12144-020-01130-3>.
- Miao, H., Wei, Z., Li, Q., Zhang, Y., Liu, X., & Guo, C. (2024). Psychological *Suzhi* and depression and anxiety among Chinese adolescents: the mediating role of negative cognitive processing bias and perceived stress. *Current Psychology*, 43(20), 18207–18217. <https://doi.org/10.1007/s12144-023-05582-1>.
- Monroe, S. M., & Simons, A. D. (1991). Diathesis-stress theories in the context of life stress research: Implications for the depressive

- disorders. *Psychological Bulletin*, 110(3), 406–425. <https://doi.org/10.1037/0033-2909.110.3.406>.
- Nguyen, T. M., Xiao, X., Xiong, S., Guo, C., & Cheng, G. (2020). Effects of parental educational involvement on classroom peer status among Chinese primary school students: A moderated mediation model of psychological *suzhi* and family socio-economic status. *Children and Youth Services Review*, 111, 104881 <https://doi.org/10.1016/j.chilyouth.2020.104881>.
- Nie, Q., Zhang, D., Teng, Z., Li, C., Meng, R., & Guo, C. (2025). The changes in students' perceived school climate and psychological *suzhi* during "Rural High School Entering the City" Program and their relationship: A one-year longitudinal study. *Psychological Development and Education*, 41(4), 571–578. <https://doi.org/10.16187/j.cnki.issn1001-4918.2025.04.13>.
- Nie, Q., Teng, Z., Yang, C., Griffiths, M. D., & Guo, C. (2024). Longitudinal relationships between school climate, academic achievement, and gaming disorder symptoms among Chinese adolescents. *Journal of Youth and Adolescence*, 53, 1646–1665. <https://doi.org/10.1007/s10964-024-01952-5>.
- Nie, Q., Teng, Z., Yang, C., Lu, X., Liu, C., Zhang, D., & Guo, C. (2021). Psychological *suzhi* and academic achievement in Chinese adolescents: A 2-year longitudinal study. *British Journal of Educational Psychology*, 91(2), 638–657. <https://doi.org/10.1111/bjep.12384>.
- Nie, Q., Yang, C., Teng, Z., Furlong, M. J., Pan, Y., Guo, C., & Zhang, D. (2020). Longitudinal association between school climate and depressive symptoms: Mediating role of psychological *suzhi*. *School Psychology*, 35(4), 267–276. <https://doi.org/10.1037/spq0000374>.
- Nie, Q., Zhang, D., Teng, Z., Lu, X., & Guo, C. (2018). How students perceived school climate effect on subjective and objective academic achievement: The mediating role of psychological *suzhi*. *Psychological Development and Education*, 34(6), 715–723. <https://doi.org/10.16187/j.cnki.issn1001-4918.2018.06.10>. (in Chinese).
- O'Hara, K. L., Duchschere, J. E., Shanholtz, C. E., Reznik, S. J., & Beck, C. J. (2019). Multidisciplinary partnership: Targeting aggression and mental health problems of adolescents in detention. *American Psychologist*, 74(3), 329–342. <https://doi.org/10.1037/amp0000439>.
- Pan, Y., Hu, Y., Zhang, D., Ran, G., Li, B., Liu, C., Liu, G., Luo, S., & Chen, W. (2017). Parental and peer attachment and adolescents' behaviors: The mediating role of psychological *suzhi* in a longitudinal study. *Children and Youth Services Review*, 83, 218–225. <https://doi.org/10.1016/j.chilyouth.2017.10.038>.
- Pan, Y., Zhang, D., & Li, Z. (2021). The effects of parental and peer attachment on the development of psychological *suzhi* among middle school students: From a person-centered perspective. *Psychological Development and Education*, 37(4), 558–567. (in Chinese).
- Rosenberg, M., Schooler, C., Schoenbach, C., & Rosenberg, F. (1995). Global self-esteem and specific self-esteem: Different concepts, different outcomes. *American Sociological Review*, 60, 141–156. <https://doi.org/10.2307/2096350>.
- Shek, D. T. (1993). The Chinese version of the State-Trait Anxiety Inventory: Its relationship to different measures of psychological well-being. *Journal of Clinical Psychology*, 49(3), 349–358. [10.1002/1097-4679\(199305\)49:3%3C349::aid-jclp2270490308%3E3.0.co;2-j](https://doi.org/10.1002/1097-4679(199305)49:3%3C349::aid-jclp2270490308%3E3.0.co;2-j).
- Storey, J. D. (2003). The positive false discovery rate: A Bayesian interpretation and the q-value. *The Annals of Statistics*, 31(6), 2013–2035. <https://doi.org/10.1214/aos/1074290335>.
- Sundarajan, L. (2020). A history of the concepts of harmony in Chinese culture. In *Oxford Research Encyclopedia of Psychology* (pp. 1–29). Oxford University Press. <https://doi.org/10.1093/acrefore/9780190236557.013.679>
- Tang, X., Tang, S., Ren, Z., & Wong, D. F. K. (2020). Psychosocial risk factors associated with depressive symptoms among adolescents in secondary schools in mainland China: A systematic review and meta-analysis. *Journal of Affective Disorders*, 263, 155–165. <https://doi.org/10.1016/j.jad.2019.11.118>.
- Teng, Z., Pontes, H. M., Nie, Q., Griffiths, M. D., & Guo, C. (2021). Depression and anxiety symptoms associated with internet gaming disorder before and during the COVID-19 pandemic: A longitudinal study. *Journal of Behavioral Addictions*, 10(1), 169–180. <https://doi.org/10.1556/2006.2021.00016>.
- Tian, L. M. (2006). Shortcomings and merits of the Chinese version of the Rosenberg (1965) self-esteem scale. *Psychological Exploration*, 26(2), 88–91. (in Chinese).
- Tudge, J. R., Navarro, J. L., Payir, A., Merçon-Vargas, E. A., Cao, H., Zhou, N., Liang, Y., & Mendonça, S. (2022). Using cultural-ecological theory to construct a mid-range theory for the development of gratitude as a virtue. *Journal of Family Theory & Review*, 14(2), 157–174. <https://doi.org/10.1111/jftr.12432>.
- Van Heeringen, K. (2012). Stress-diathesis model of suicidal behavior. In Y. Dwivedi (Ed.), *The neurobiological basis of suicide* (chap. 6). CRC Press/Taylor & Francis.
- Vyas, S., & Kumaranayake, L. (2006). Constructing socioeconomic status indices: How to use principal components analysis. *Health Policy and Planning*, 21(6), 459–468. <https://doi.org/10.1093/heapol/czl029>.
- Wang, H., Jia, R., Zhang, M., & Fan, W. (2024). The influence of stress on mental health among Chinese college students: The moderating role of psychological *suzhi*. *Heliyon*, 10(5), E26699 <https://doi.org/10.1016/j.heliyon.2024.e26699>.
- Wang, X., Zhu, N., Wei, M., Chen, S., Liu, W., & Liu, Y. (2025). Longitudinal associations and gender differences of parent-child relationships on aggression in Chinese adolescents: The mediating role of psychological *suzhi*. *Aggressive Behavior*, 51(3), e70031 <https://doi.org/10.1002/ab.70031>.
- Wang, X. Q., & Zhang, D. (2012). The criticism and amendment for the dual-factor model of mental health: From Chinese psychological *suzhi* research perspectives. *Journal of International Journal of Clinical Medicine*, 3, 319–327. <https://doi.org/10.4236/ijcm.2012.35063>.
- Wang, X. Q., & Zhang, D. (2015). *The relationship model between psychological suzhi and mental health among adolescents*. (China Science Press).
- Wu, D., Chen, S., Chen, Y., Li, D., & Yin, H. (2023). The impact of peer victimization on Chinese left-behind adolescent suicidal ideation: The mediating role of psychological *suzhi* and the moderating role of family cohesion. *Child Abuse & Neglect*, 141, 1–13. <https://doi.org/10.1016/j.chiabu.2023.106235>.
- Wu, L., Ding, F., Zhang, T., He, H., Wang, J., Pan, Y., & Zhang, D. (2022). Psychological *suzhi* moderates state anxiety and heart rate responses to acute stress in male adolescents. *Stress and Health*, 38(3), 581–590. <https://doi.org/10.1002/smi.3119>.
- Wu, L., Zhang, D., Cheng, G., & Hu, T. (2018). Bullying and social anxiety in Chinese children: Moderating roles of trait resilience and psychological *suzhi*. *Child Abuse & Neglect*, 76, 204–215. <https://doi.org/10.1016/j.chiabu.2017.10.021>.
- Wu, L., Zhang, D., Zhang, X., & Cheng, G. (2017). Development of national norms for the Brief Psychological *Suzhi* Scale in middle school students. *Journal of Southwest University (Social Sciences Edition)*, 43(06), 98–105. <https://doi.org/10.13718/j.cnki.xdsk.2017.06.012>. (in Chinese).
- Yang, C. (2022). Application of positive psychology in Chinese school contexts. In K.-A., Allen, M. J., Furlong, D., Vella-Brodrick, & S. M. Suldo (3rd ed.), *Handbook of positive psychology in schools* (pp. 466–477). Routledge/Taylor & Francis Group.
- Zhang, D. (2012). Integrating adolescents' mental health and psychological *suzhi* cultivation. *Journal of Psychological Science*,

35(3), 530–536. <https://doi.org/10.16719/j.cnki.1671-6981.2012.03.001>. (in Chinese).

- Zhang, D., Feng, Z., Guo, C., & Chen, X. (2000). Problems in research of students' psychological *suzhi*. *Journal of Southwest China Normal University (Humanities and Social Sciences Edition)*, 26, 56–62. <https://doi.org/10.3969/j.issn.1673-9841.2000.03.012>. (in Chinese).
- Zhang, D., & Shao, J. (2025). *Suzhi*. In *The ECPH encyclopedia of psychology* (pp. 1478–1479). Springer Nature Singapore.
- Zhang, D., Lu, X., Cheng, G., & Pan, Y. (2017a). Development of national norms of the Brief Psychological Suzhi Scale for primary students. *Journal of Southwest University (Social Sciences Edition)*, 43(06), 91–97. <https://doi.org/10.13718/j.cnki.xdsk.2017.06.011>. (in Chinese).
- Zhang, D., Su, Z., & Wang, X. (2017b). Thirty-year study on the psychological *suzhi* of Chinese children and adolescents: Review and prospect. *Studies of Psychology and Behavior*, 15(1), 3–11. <https://doi.org/10.3969/j.issn.1672-0628.2017.01.002>. (in Chinese).
- Zhang, D., Wang, J., & Yu, L. (Eds.). (2011). *Methods and implement strategies for cultivating students' psychological suzhi*. Nova Science.
- Zhao, Z., Liu, G., Nie, Q., Teng, Z., Cheng, G., & Zhang, D. (2021). School climate and bullying victimization among adolescents: A moderated mediation model. *Children and Youth Services Review*, 131, 106218. <https://doi.org/10.1016/j.childyouth.2021.106218>.
- Zhao, Z., Liu, G., Li, S., & Zhang, X. (2018). Peer victimization and behavior Problems in Adolescence: Mediation and moderation effects of psychological *suzhi*. *Journal of Southwest University (Social Sciences Edition)*, 44(5), 91–97. <https://doi.org/10.13718/j.cnki.xdsk.2018.05.011>. (in Chinese).

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.

Qian Nie is a Lecturer at School of Journalism and Communication, Southwest University in China. Her research focuses on problematic media use, psychological *suzhi*, gaming disorder, and mental health outcomes.

Chunyan Yang is an Associate Professor of School Psychology affiliated with the College of Education at the University of Maryland,

College Park. Her main research interests include bullying prevention, teacher-targeted violence, and social and emotional learning.

Chun Chen is an Assistant Professor at the Chinese University of Hong Kong, Shenzhen. Her research focuses on bullying, cyberbullying, and social and emotional learning.

Michael J. Furlong is a Distinguished Professor at the University of California, Santa Barbara. His research interests include school psychology and positive psychology.

Mei-Ki Chan is an Assistant Professor at Berkeley School of Education, University of California. Her research focuses on school-based mental health screening and the influence of school contexts and practices on the development of marginalized children and youth.

Dajun Zhang is a Professor of Psychology at Southwest University. His research focuses on educational psychology, including psychological *suzhi*, mental health and social adaptation.

Cheng Guo is a Professor of Psychology at Southwest University in China. His main research interests concern how school culture affect students' mental health and social adjustment.

Zhaojun Teng is an Associate Professor of Psychology at Southwest University in China. His research focuses on video game use and its associations with aggression, bullying, addiction, and mental health problems.