A person-centered analysis of emotional-behavioral functioning profiles in adolescents: Associations with teacher autonomy support and growth mindset

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Abstract

Anchored in the socio-ecological framework, the current study examined the association of teacher autonomy support with emotional-behavioral functioning profiles using a person-centered approach and investigated whether growth mindset and adolescents' gender would moderate this association. To achieve these research objectives, this study involved 1741 adolescents (54.1% girls; $M_{age} = 12.62$; $SD = 1.50$) who were uniformly instructed to fill in a set of self-report questionnaires. Results based on latent profile analysis revealed four emotional-behavioral functioning profiles: primarily externalizing (6.2%), comorbid (32.9%), well-adjusted (53.7%), and high-risk (7.2%). Adolescents with high teacher autonomy support were more likely to be group members of the well-adjusted profile than the remaining three emotional-behavioral functioning profiles. Moreover, interaction analyses demonstrated that girls benefited more when teacher autonomy support and growth mindset were congruently high, whereas boys did not. The current findings suggest that teachers should be equipped with sufficient skills and training to maintain an autonomy-supportive classroom climate. Meanwhile, growth mindset intervention may develop into an integral part of the school's activities to facilitate adolescents' optimal emotional-behavioral functions, but distinctly gendered pathways for these activities should be carefully considered.

Keywords Internalizing problems · Externalizing problems · Prosocial behavior · Teacher autonomy support · Growth mindset · Gender

Introduction

Adolescents have been demonstrated highly prevalence for internalizing and externalizing problems that have short- and long-term maladaptive implications on their broad psychosocial functions and academic/work performance, such as poor well-being, social interaction difficulties, academic underachievement, and work incapacity (Arslan et al., 2021; Lewis et al., 2017; Narusyte et al., 2017). These adverse effects are even more pronounced in the context of Chinese culture, which emphasizes social harmony and interdependence among individuals (Bond, 2010; Lan et al., 2021). For

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instance, a primary socialization goal for Chinese adolescents is obedience of moral and social rules, entailing an often tedious and strict discipline process that may trigger their internalizing and externalizing problems (Lan, 2020; Xing et al., 2011). However, Chinese society culturally inhibits emotional and behavioral patterns that violate social norms, as behaviors against normative practices influence the psychosocial adaptation of the adolescents themselves within a specific community and subsequently impact the dignity and reputation of the whole family. Given these salient cultural features, it is particularly important to examine the correlates of Chinese adolescents' emotional-behavioral functions to integrate empirically derived evidence into designing school-based intervention or prevention programs.

In the current study, we refer to developmental systems theory, i.e., the socio-ecological framework, to investigate the correlates of adolescents' emotional-behavioral functions (Bronfenbrenner & Morris, 2006). According to the socio-ecological framework, adolescents are embedded in a complex yet layered system that includes contextual and

individual factors. Accordingly, adolescents' emotional and behavioral functions are established and perpetuated over time through mutual interactions among several contextual and individual factors. Guided by this widely used socio-ecological framework, scientists have produced fruitful research outcomes and generated vital knowledge about child development across diverse disciplines. However, past published investigations have typically segmented these factors, with a dearth of explorations focused systematically on the interactions among the factors themselves (Gurven, 2018; Lan & Zhang, 2019). In seeking to expand the theoretical applications of the socio-ecological framework into empirical studies and relevant practices, having a comprehensive and systematic understanding of the correlates of adolescents' emotional-behavioral functions is vital.

The large amount of time adolescents spend at school casts teachers as one of the salient social agents facilitating their optimal functions. Furthermore, relationships with teachers potentially interact with adolescents' personal characteristics, such as growth mindset and gender, in explaining the variability of their emotional-behavioral functions. According to this perspective, the current study employed Chinese adolescents on a large scale to investigate the direct and interactive associations of teacher autonomy support, growth mindset, and adolescents' gender with emotional and behavioral functioning profiles. Through this integrative and systematic investigation, the current study raised the bar by addressing striking yet urgently needed conceptual gaps, advancing the existing scholarship on the correlates of adolescents' emotional and behavioral functions, and ultimately offering guidance for social-ecologically informed and tailored intervention/prevention programs.

In the sections that follow, we further elaborate on the focal variables mentioned above, starting with reviewing emotional-behavioral functions.

Emotional-behavioral Functions: A Person-centered Approach

Prior research has drawn extensively on a variable-oriented approach to understand the relationships between variables of interest and segregated scores of internalizing/externalizing problems, assuming that the studied population is inherently homogeneous (Cui & Lan, 2020). The adolescent population, however, is highly heterogeneous, exhibiting dramatic diversities and individual differences that cannot be ignored (Bergman et al., 2006). In this regard, there is much value in employing a person-centered approach to emotional-behavioral functions that classify adolescents into distinct subgroups characterized by different natural configurations of emotional and behavioral patterns (Howard & Hoffman, 2018). Such an approach would identify potentially vulnerable or at-risk groups, and examining the

association of these group memberships with relevant variables of interest could aid in crafting specific intervention and prevention programs (Ma et al., 2022).

To achieve a more comprehensive and nuanced understanding of adolescents' emotional-behavioral functions in this study, we used the Strengths and Difficulties Questionnaire (SDQ; Goodman et al., 1997). First, the SDQ contains both positive (i.e., prosocial behavior) and negative dimensions (i.e., internalizing and externalizing problems) of emotional-behavioral functions, offering the opportunity to catch both developmental assets and deficits simultaneously (Antaramian et al., 2010; Suldo & Shaffer, 2008). Second, the widely used SDQ has been validated in various languages and cultural contexts (Goodman & Goodman, 2009), including the Chinese version (Du et al., 2008), demonstrating good psychometric properties (Liu et al., 2013). Additionally, the SDQ's brevity and ease of comprehension would potentially alleviate adolescents' fatigue when participating in this study.

A burgeoning body of research has employed a person-centered approach relying on the SDQ to generate valuable findings. For example, McElroy et al. (2017) reported four emotional-behavioral functioning profiles using a sample of children from the UK: normative, primarily internalizing, primarily externalizing, and high-risk/multimorbid. Similarly, Morales et al. (2021) found a four-profile solution in Spanish children: high difficulties, internalizing, externalizing, and well-adjusted. Additionally, Muratori et al. (2021) showed four profiles in Italian adolescents: no psychopathology, low psychopathology with sub-threshold hyperactivity, predominantly internalizing, and predominantly externalizing. Indeed, using a person-centered approach to identify emotional-behavioral functioning profiles has gained increasing popularity in the literature; studies leveraging the samples beyond Western cultural contexts are, however, limited. One exception is Ling et al.'s (2016) three-profile solution using a latent class analysis in Chinese adolescents: high difficulties group, uncooperative group, and well-adjusted group, which was partially inconsistent with the profile solutions reviewed above. Therefore, additional investigation is still urgently needed to clarify these inconsistent findings, and perhaps more importantly, to further demonstrate the contextual and individual associations of these emotional-behavioral functioning profiles, such as teacher autonomy support.

Teacher Autonomy Support

According to self-determination theory (Deci & Ryan, 2012; Ryan & Deci, 2017), autonomy, as one of the inherent psychological needs, refers to the experience of initiating and regulating behaviors from a volitional and self-endorsed perspective. The satisfaction of autonomy underpins healthy

psychological growth and effective self-regulation (Deci & Ryan, 2012). To foster adaptive development patterns, salient figures in adolescents' social spheres (e.g., teachers) should support the adolescents' autonomous functioning and internalization by offering choice and rationale, and encouraging students to pursue their own volition (Deci & Ryan, 2012; Núñez & León, 2015). When autonomous, adolescent tend to exhibit greater flexibility and higher well-being. Otherwise, many emotional distress and behavioral disorders may emanate from the reactivity to tyrannical and rigid external control (Deci & Ryan, 2012; Núñez & León, 2015). This functional importance in adaptive emotional-behavioral functions underscores the need of addressing the association of teacher autonomy support with adolescents' emotional-behavioral functions.

In the present study, we particularly focused on head teachers as they usually supervise the same group of students for several years, providing an ideal condition under which to render adequate autonomy support (Feng & Li, 2016). Furthermore, it is noteworthy that head teachers often take primary responsibility for disciplining adolescent behaviors based on social norms and school regulations, which may be highly relevant to restraining students' emotional and behavioral dysfunctions (Chang, 2003). In addition, showing respect for teachers is a traditional virtue, and in this context, students often regard the head teachers as an authority and "life coach" (Feng & Li, 2016). Therefore, head teachers play a particularly crucial role in facilitating adolescents' optimal emotional-behavioral functions, perhaps going beyond the roles of parents and peers during this period of adolescents' lives.

Overwhelming evidence has shown that fulfilling autonomy needs can promote positive developmental outcomes among adolescents (Deci & Ryan, 2012; Reeve & Cheon, 2021). In the school environment, previous studies have suggested that teacher autonomy support is positively associated with adaptive emotional-behavioral functions in Chinese youth, such as social competence (Ma et al., 2020a) and emotional well-being (Lan & Zhang, 2019). The authors of both studies explained in their findings that increased intrinsic motivation, psychological freedom, and independence of volition are conductive to adaptive emotional-behavioral patterns. Despite these advances, further research should still corroborate and consolidate this finding by focusing on a broader and more diverse view of the outcomes, as some researchers have argued that the positive role of teacher autonomy support in adolescent adaptive patterns is less salient in Eastern cultures that emphasize obedience to authority (Markus & Kitayama, 1991; Rothbaum et al., 2000). We acknowledge that traditional Chinese teachers are assumed to be less autonomy-supportive and more controlling; however, contemporary Chinese teaching ideologies may have been adapted in response to dramatic socio-cultural changes

(Yu et al., 2016), thus warranting an updated investigation of the association of teacher autonomy support with adolescents' emotional-behavioral functions.

Furthermore, according to the socio-ecological framework (Bronfenbrenner & Morris, 2006), individual characteristics may moderate this understudied association. Given the increasing research attention to the buffering role of growth mindset on a wide range of optimal psychosocial functions Burnette et al., 2013; Claro et al., 2016; Infurna & Luthar, 2016), the current study explored the role of growth mindset in this understudied association, as we elaborated upon below.

Growth Mindset

Implicit theory describes how an individual implicitly holds different views of his or her own basic attributes, such as intelligence and personality. There are two distinct schematic knowledge structures: incremental or entity, and adolescents gravitate to either end of the dyad of these structures. Specifically, adolescents with an entity mindset (also called a fixed mindset) are prone to regarding basic attributes as unalterable, whereas adolescents with an incremental mindset (also called a growth mindset) are likely to view these attributes as malleable and cultivatable through efforts (Dweck et al., 1995; Yeager & Dweck, 2012, 2020). Prior research has shown that growth mindset is positively related to self-regulation and academic achievement, which has been shown mainly in the growth mindset with regard to intelligence (Ma et al., 2020b; Wang et al., 2020). Given the focus of the current study, we extend prior scholarship by focusing on the growth mindset toward personality, as it is generally acknowledged that personality traits play an essential role in the etiology and maintenance of emotional-behavioral difficulties in adolescence (e.g., Muris et al., 2007).

According to previous research, individuals with high levels of growth mindset can effectively deal with adverse life events (Burnette et al., 2013; Claro et al., 2016) and adequately adjust their emotions and behaviors and may be more likely to have better self-regulatory abilities that can effectively cope with challenging life situations Burnette et al., 2013; Claro et al., 2016; Infurna & Luthar, 2016). Despite a handful of studies demonstrating this, relatively little is known about how the growth mindset toward personality may interact with contextual variables (e.g., teacher autonomy support) to explain the variance of adolescents' emotional-behavioral functions. According to the above-mentioned empirical studies, we assumed that adolescents with high levels of growth mindset could mitigate the adverse effect of low teacher autonomy support on emotional-behavioral difficulties.

Gender Differences

Regarding individual differences in emotional-behavioral functions, gender is another potentially salient factor influencing the conditional relations of teacher autonomy support with adolescents' emotional-behavioral functions. It has been widely accepted that girls are more prevalent in internalizing problems due to greater stability in interpersonal vulnerabilities (e.g., Hankin & Abramson, 2001), whereas boys often exhibit more externalizing problems because of greater stability in their vulnerability to self-criticism (e.g., Leadbeater et al., 1999; Thijs et al., 2015). Considering this, it would be essential to ascertain gender differences in under-investigated associations to demand specific modifications in intervention or prevention programs at school.

Moreover, gender differences also emerge in teacher-student interactions. Previous studies have consistently shown that teachers generally hold emotionally closer and less conflictual relationships with girls than with boys (e.g., Spilt et al., 2012). From this perspective, the beneficial role of teacher autonomy support in adolescents' emotional-behavioral functions may be stronger in girls than boys. Another contrastive perspective is the academic risk hypothesis, which indicates that teacher support would substantially influence boys' broad functions at school, as boys usually confront a greater risk of academic underachievement than girls (Hamre & Pianta, 2001; Roorda et al., 2011). Given that this gender interaction remains inconclusive in extant research, the current study therefore extended this line of research by incorporating adolescents' gender, as one exploratory moderator, in understudied associations.

The Present Study

The present study extends previous studies by employing a latent profile analysis to identify emotional-behavioral functioning profiles in a large sample of normative Chinese adolescents, examining the association of teacher autonomy support with these emerging profiles, and investigating whether growth mindset and adolescents' gender may moderate this association. Two research questions (RQ) are generated in this context:

RQ1: Is it possible to identify emotional-behavioral functioning profiles based on SDQ indicators?

RQ2: What is the association of teacher autonomy support with these emerging emotional-behavioral functioning profiles? Moreover, would growth mindset and adolescents' gender moderate this conditional association?

Although the current study was guided by an overarching theoretical framework (Bronfenbrenner & Morris, 2006), understanding the interactive patterns of studied variables on emotional-behavioral functions is a very complex issue. Moreover, the expected findings of this study depended widely on the identification of latent emotional-behavioral functioning profiles. Thus, the current study was predominantly exploratory in nature. Nevertheless, some initial expectations can be made based on the current literature review:

Concerning RQ1, in accordance with previous literature (Ling et al., 2016; McElroy et al., 2017; Morales et al., 2021; Muratori et al., 2021), we expected a three- or four-profile solution, such as primarily internalizing, primarily externalizing, well-adjusted, and high-risk.

Concerning RQ2, combining the tenets from the self-determination theory (Deci & Ryan, 2012) and the increasing empirical evidence concerning the beneficial role of teacher autonomy support in adaptive psychosocial functions of adolescents (e.g., Lan & Zhang, 2019; Yu et al., 2016), we hypothesized that adolescents with high teacher autonomy support might be likely to be group members in the "well-adjusted" profile than in the "high-risk" profile. Furthermore, considering that adolescents with high levels of growth mindset tend to be more adaptive when facing negative experiences (Niu et al., 2020), we anticipated that high levels of growth mindset might increase the possibility of belonging to the well-adjusted group. Additionally, given the complex but inconsistent findings involving adolescents' gender and the scarcity of literature in this research field, we did not generate a priori expectation.

Of note, when investigating RQ2, we statistically controlled for adolescents' age and their families' socioeconomic status (SES), as prior research has shown that these sociodemographic characteristics are potentially related to adolescents' emotional-behavioral functions (Keyes et al., 2019; Zhou et al., 2018).

Methods

Participants and Procedures

The current study was based on a larger research project aimed at understanding the correlates of adolescents' psychosocial and academic functions. This research project, in collaboration with several public schools, has been repeatedly conducted on an annual basis in order to provide evidence-based strategies for facilitating adolescents' optimal functions in school settings. The current study leveraged the cross-sectional data collected between June and July 2019. Before collecting data, we obtained ethics approval from the Institutional Review Board affiliated with the first author's university. We contacted public primary and secondary schools serving socio-demographically diverse populations to explain the research purposes and administration details. School principals gave verbal authorization officially allowing research to be conducted during school hours, and

determined which grades would be approached for recruitment, considering student availability and willingness to participate. Subsequently, an equal number of classes from each grade at each school was invited to participate in this research project.

The aforementioned socio-ecological framework guided the selection of variables of interest across different layered levels (Bronfenbrenner & Morris, 2006), and a power analysis was employed to pre-determine the expected sample size. In accordance with the socio-ecological framework, multiple interactions (i.e., moderation effects) across contextual and individual levels were expected to be examined in multivariate regression models, with the option of adding two or three socio-demographic covariates for the robustness of the research findings. In this regard, a total of 7–10 predictors were expected to be inserted into the anticipated regression models. According to previous published studies (e.g., Aguinis et al., 2005), a small effect size ($f^2 = 0.02$) was more frequently observed when evaluating the moderating effects in multivariate regression. Therefore, to achieve a 95% statistical power, we estimated that a minimum of 1100–1200 adolescents would be sufficient to make significant statistical inferences (Cohen, 1988).

Following prior research on Chinese adolescents (e.g., Feng & Lan, 2020), we administered a passive parental consent procedure, as active consent often results in a relatively low participation rate, and parents who return the written consent will be more likely to be highly educated, which may lead to biased estimates (Hollmann & McNamara, 1999). Furthermore, in China, head teachers often serve as de facto guardians, in lieu of parents, in terms of school-based research (Xu et al., 2018). More specifically, our research group members held in-person meetings with head teachers, explaining research objectives, participants' rights, the confidentiality and anonymity of the study, and administration details including the passive consent process and subsequent student surveys. Meanwhile, we asked head teachers to send a pre-designed message to parent-teacher groups on WeChat (a widely used social media platform often used to connect parents with teachers in China), informing all parents about this research project. Parents with any potential concerns or who were not willing to allow their children to participate could send a private message to inform the responsible head teachers, and their children would be assigned other academic tasks while the current study was administered during school hours. At the same time, students were asked whether they were willing to participate in this investigation.

During school hours, our research group members, with the assistance of the head teachers in each classroom, implemented this investigation and supervised students to ensure sufficient attention to any questions or difficulties. On average, students took approximately 30–35 min to complete the well-designed questionnaire battery written in simplified Chinese presented in a paper-to-pencil format. Data were coded by adolescent ID and kept in locked cabinets and password-protected computers. A non-probabilistic sampling technique resulted in 1770 adolescents participated in this study, with a 91.3% participation rate[1]. After data was collected, 29 adolescents were omitted from the current study due to missing values in key variables of interest and violating statistical assumptions (see more details in the "Data Analysis" section), yielding a final research sample of 1741 adolescents employed in subsequent analyses.

Of these adolescents, 54.1% were girls, and their mean age was 12.62 years old ($SD = 1.50$). At the time of the data collection, adolescents attended fourth, fifth, sixth, seventh, and eighth grades in public schools. In terms of parental education levels, most adolescents' fathers (28.8%) and mothers (34.2%) had completed a high school education. Most adolescents in this study came from medium-income families, with an average score of 5.07 ($SD = 1.77$) on the family affluence scale (FAS; Boyce et al., 2006; see measurement sections for more information).

Measures

Emotional-behavioral Functions

Emotional-behavioral functions were assessed by the self-rated version of the SDQ (Goodman et al., 1997). The SDQ encompasses five subscales, including emotional symptoms, peer relationships problem, hyperactivity, conduct problems, and prosocial behavior. Emotional symptoms and peer relationships problem were treated as an overall internalizing subscale, whereas hyperactivity and conduct problems were regarded as an global externalizing subscale (Goodman et al., 2010). Examples of items include "I am often unhappy, downhearted, or tearful (emotional problems)"; "I take things that are not mine (conduct problems)"; "I often volunteer to help others (prosocial behavior)."Adolescents were required to rate each item based on their emotions and behaviors in the past six months, applying a three-point ordinal Likert scale (0-*not true*, 1-*somewhat true*, or 2-*certainly true*). Goodman et al. (2010) have suggested that when testing for normative children and adolescents,

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[1] Despite the lack of broad generalizability relative to probability samples, the convenience sampling technique remains widely used within developmental science due to its cost-effective and efficient merits (Bornstein et al., 2013; Jager et al., 2017). Likewise, collaborating schools that serve socio-demographically diverse populations may somewhat compensate for this sampling weakness. Perhaps more importantly, using such a convenience sampling method is in line with our research objectives, which were to timely reflect on students' global emotional-behavioral functions and expeditiously provide professional perspectives and guidance.

three broad-band dimensions (i.e., internalizing problems, externalizing problems, and prosocial behavior) should be employed instead of five separated subscales. In accordance with this argument, the sum scores of these three broad-band dimensions were calculated, with greater values suggesting higher internalizing problems, externalizing problems, and prosocial behavior. Previous studies have demonstrated good psychometric properties of the SDQ in Chinese adolescents (e.g., Liu et al., 2013). In the current study, Cronbach's alpha for internalizing, externalizing, and prosocial behavior was 0.70, 0.65, and 0.70.

Teacher Autonomy Support

Teacher autonomy support was assessed using the short form of the Learning Climate Questionnaire (LCQ; Black & Deci, 2000). This questionnaire consists of 6 items, and one of the item examples is, "my head teacher tries to understand how I see things before suggesting a new way to do things." Participants were asked to assess each item on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The mean score of all items was generated, with higher scores indicating higher levels of teacher autonomy support. Prior study has addressed good internal consistency of the LCQ in Chinese adolescents (e.g., Lan & Zhang 2019). In this study, Cronbach's alpha was 0.90.

Growth Mindset

Growth mindset was measured using one of the subscales of the Implicit Theory Scale (Dweck et al., 1995). This subscale contains three items, and one of the item examples is, "People can do things differently, but the important parts of who they are cannot really be changed." Adolescents were asked to rate each item based on the 6-point scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). All these items were reverse-coded, and the mean score for all the items was calculated, with a higher score indicating a stronger growth mindset with regard to personality. Prior research has shown good internal consistency of this scale in Chinese adolescents (Wang et al., 2020). In the current study, Cronbach's alpha was 0.70.

Sociodemographic Characteristics

Adolescents were asked a few questions indicating their age, gender, grade levels, parental education levels, and family SES. Specifically, family SES was measured using the 4-item FAS (Boyce et al., 2006; Liu et al., 2012). A summed score for all items was generated, with higher scores indicating higher family SES. As reported by prior research (Boyce et al., 2006), scores from 0 to 2 indicate low affluence, 3 to 5 medium affluence, and 6 to 9 high affluence.

Data Analysis

Data were analyzed with SPSS (version 27; IBM, 2020) and Jamovi (version 2.0; the jamovi project, 2021). Prior to conducting the analysis, the assumptions of regression analyses were carefully examined. Specifically, we calculated Mardia's multivariate skewness and kurtosis to check the multivariate normality (Mardia, 1970) and the Mahalanobis distance to identify possible multivariate outliers. Overall, eleven cases were omitted due to the violation of analysis assumptions. Additionally, eighteen adolescents were excluded from the current study because they did not indicate their gender, which was one of the key variables in this study. To characterize study variables and their bivariate correlations, we first presented descriptive information using means and standard deviations for continuous variables, and conducted Pearson's correlations to evaluate their correlations. Moreover, a series of independent *t*-tests were used to evaluate gender differences in study variables.

Regarding RQ1, a latent profile analysis was applied to identify latent subgroups based on three broad-band indicators (i.e., internalizing problems, externalizing problems, and prosocial behavior). We performed this analysis, starting from a one-profile solution, and one additional number of profile solution was accordingly added. An optimal model was initially selected based on model fit indices (e.g., AIC, BIC, aBIC), and the likelihood ratio test (Nylund et al., 2007; Tein et al., 2013). Subsequently, entropy scores and the smallest percentage of the profile solutions were regarded as important reference values when selecting the best model. Finally, the optimal statistical model was examined for its theoretical interpretability and consistency with prior literature. Once the model solution was determined, a MANCOVA was conducted to confirm the discriminant degree of these profiles across selected indicators.

With regard to RQ2, a multinomial logistic regression was conducted to investigate the direct and interactive association of teacher autonomy support, growth mindset, and adolescents' gender with these emerging emotional-behavioral functioning profiles. In case of significant interactions, simple slope analyses and corresponding plots were performed to decompose these conditional effects in a bid to understand the nature/structure of the interactive patterns (Aiken & West, 1991; Preacher et al., 2006).

Results

Descriptive Statistics and Correlation Analyses

Means, standard deviations, and bivariate correlations of study variables are reported in Table 1, separated by boys and girls. As shown in Table 1, for both boys and girls,

teacher autonomy support was negatively associated with internalizing problems and externalizing problems but positively related to prosocial behavior. For boys, growth mindset was negatively linked to internalizing problems, whereas, for girls, growth mindset was negatively associated with both internalizing problems and externalizing problems.

Identifying Emotional-behavioral Functioning Profiles

The model fit indices of emotional-behavioral functioning profiles are presented in Table 2. The likelihood ratio test was significant for the 2-, 3-, and 4-profile solutions. Compared with the 2- and 3-profile solutions, the 4-profile solution had lower AIC, BIC, aBIC, and similar entropy levels. Therefore, a 4-profile solution was regarded as the optimal model, which was employed in further analyses.

Four profile solutions were interpreted and labeled based on previous studies on emotional-behavioral functioning profiles (McElroy et al., 2017; Morales et al., 2021; Muratori et al., 2021). Adolescents in the first profile ($n = 108$, 6.2%) exhibited high scores of externalizing problems but low scores in both internalizing problems and prosocial behavior, and thus this group of adolescents was labeled "primarily externalizing"; adolescents in the second profile ($n = 573$, 32.9%) were characterized by the mild and similar symptoms of both internalizing and externalizing domains but low scores in prosocial behavior, and thus this group of adolescents was labeled "comorbid"; adolescents in the third profile ($n = 935$, 53.7%) showed the lowest scores in both internalizing and externalizing problems but the highest scores in prosocial behavior, and thus a label named "well-adjusted" was assigned to this group of adolescents; finally, adolescents in the fourth profile ($n = 125$, 7.2%) reported the highest scores in both internalizing and externalizing problems, as well as an average level of prosocial behavior, and thus this group of adolescents was labeled "high-risk"(see Fig. 1).

Subsequently, a MANOVA was performed, with across three selected indicators (i.e., internalizing problems, externalizing problems, and prosocial behavior) as independent variables and four emotional-behavioral functioning profiles as the dependent variable. The results showed that the scores of these three indicators were highly discriminated across four emotional-behavioral functioning profiles. The corresponding results have been reported in Table 3.

The Associations of Teacher Autonomy Support, Growth Mindset, Adolescents' Gender With Emotional-behavioral Functioning Profiles

The results of the multinomial logistic regression are reported in Table 4. In this step of the analysis, we compared

Table 1 Descriptive statistics and bivariate correlations of study variables for adolescents

Variables	Boys (n = 843) M	SD	Girls (n = 898) M	SD	t	1	2	3	4	5	6	7
1. Teacher autonomy support	4.75	1.36	5.01	1.33	-3.99***	-	-0.01	-0.22***	-0.29***	0.28***	0.12***	0.07*
2. Growth mindset	3.80	1.18	3.79	1.16	0.10	-0.03	-	-0.09**	-0.07*	0.02	0.12***	0.01
3. Internalizing problems	6.80	3.63	6.44	3.45	2.15*	-0.20***	-0.07*	-	0.54***	-0.15***	-0.05	-0.07*
4. Externalizing problems	7.56	3.32	6.71	3.17	5.47***	-0.23***	-0.06	0.56***	-	-0.25***	-0.02	-0.06
5. Prosocial behavior	7.04	2.06	7.45	2.01	-4.21***	0.29***	-0.01	-0.07*	-0.18***	-	0.03	0.03
6. Age	12.59	1.55	12.65	1.46	-0.72	0.21***	0.10**	-0.05	-0.01	0.02	-	-0.10**
7. Socioeconomic status	5.04	1.80	5.09	1.75	-0.58	0.04	0.00	-0.02	0.03	0.04	-0.11**	-

Note. N = 1741. Correlation coefficients displayed above the diagonal are for girls, below for boys

* p < .05 ** p < .01 *** p < .001

Table 2 Goodness of fit indices for different latent emotional-behavioral functioning profiles

Profile	AIC	BIC	aBIC	Entropy	LMR-LRT	BLRT	Smallest profiles (%)
1-	25861.73	25894.51	25875.44	-	-	-	-
2-	25141.21	25195.83	25164.06	0.71	704.90***	728.52***	34.9%
3-	24982.70	25059.17	25014.70	0.73	161.10***	166.50***	8.4%
4-	**24937.81**	**25036.13**	**24978.95**	**0.72**	**51.17****	**52.89****	**6.2%**
5-	24891.55	25011.72	24941.82	0.68	52.50	54.26	5.7%

Note. $N = 1741$. The optimal model is highlighted in bold type. AIC = Akaike information criteria, BIC = Bayesian information, aBIC = Adjusted Bayesian information, LMR-LRT = Lo-Mendell-Rubin adjusted likelihood ratio test, and BLRT = Bootstrapped likelihood ratio test

** $p < .01$, *** $p < .001$
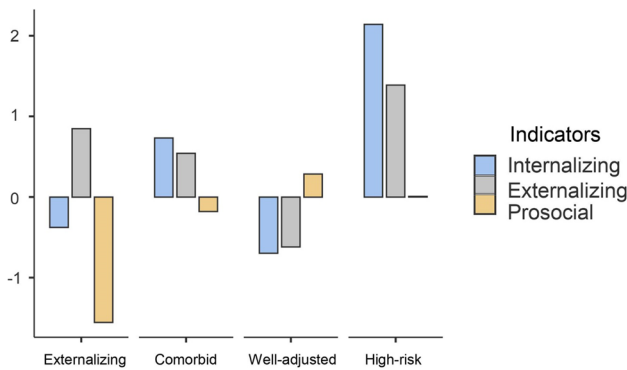
Fig. 1 Four emotional-behavioral functioning profiles based on the strengths and difficulties questionnaire (z-standardized means). *Note.* $N = 1741$

the well-adjusted profile with the other three emotional-behavioral functioning profiles characterized by varying degrees of psychopathological symptoms.

As shown in Table 4, adolescents with high teacher autonomy support were more likely to be group members in the well-adjusted profile than the other three profiles; adolescents with higher levels of growth mindset tended to be group members of the well-adjusted profile than the comorbid and high-risk profiles. In addition, girls were more likely to be group members of the well-adjusted profile than boys.

Furthermore, interaction analyses exhibited a significant two-way interaction between teacher autonomy support and growth mindset on the profiles contrast between "well-adjusted" and "high-risk", and a significant three-way interaction among teacher autonomy support, growth mindset, and adolescents' gender on the profiles contrast between "well-adjusted" and "comorbid". These significant interaction terms were further interpreted by simple slope analyses and corresponding figures.

In terms of the significant two-way interaction, the results exhibited that, for both higher ($M + 1SD$) and lower ($M - 1SD$) levels of growth mindset, the profiles contrast yielded a similar level of significance ($b = -0.26$, $SE = 0.10$, $\beta = 0.76$, 95% CI for β [0.63, 0.93], odds ratio = -2.62, $p = .009$ for lower growth mindset; $b = -0.58$, $SE = 0.09$, $\beta = 0.55$, 95% CI for β [0.45, 0.67], odds ratio = -5.88, $p < .001$ for higher growth mindset). From a descriptive point of view (see Fig. 2) and inspection of the values of odds ratio reported above, we concluded that, in the context of high teacher autonomy support, adolescents with higher levels of growth mindset were more likely to be group members of the well-adjusted profile than the high-risk profile; by contrast, in the context of low teacher autonomy support, the levels of growth mindset did not significantly influence the probability of belonging to the well-adjusted profile or the high-risk profile.

Table 3 Mean differences in study indicators across four emotional-behavioral functioning profiles

	1. Primarily externalizing (n =108)		2. Comorbid (n = 573)		3. Well-adjusted (n = 935)		4. High-risk (n =125)				
	M	SD	M	SD	M	SD	M	SD	F	Partial η2	Post hoc
Internalizing problems	5.29	1.41	9.22	1.62	4.16	1.77	14.22	1.62	1987.43***	0.77	4 > 2 > 1 > 3
Externalizing problems	9.91	2.45	8.91	2.44	5.11	2.3	11.67	2.28	544.10***	0.48	4 > 1 > 2 > 3
Prosocial behavior	4.08	1.69	6.89	1.91	7.84	1.73	7.27	2.2	147.98***	0.2	3 > 4 > 2 > 1

Note. $N = 1741$

*** $p < .001$

Table 4 Regression analysis predicting emotional-behavioral functioning profiles from teacher autonomy support, growth mindset, adolescents' gender, covariates, and interaction effects

Profiles contrast	Variables	b	SE b	β	95% CI for β		Odds ratio	p
Well-adjusted vs. Primarily externalizing	Teacher autonomy support (TAS)	-0.67	0.08	0.51	0.43	0.60	-7.99	<0.001
	Growth mindset	-0.18	0.11	0.83	0.68	1.03	-1.72	0.09
	Gender [a]	-0.95	0.26	0.39	0.23	0.64	-3.66	<0.001
	Age	-0.07	0.07	0.93	0.81	1.07	-0.97	0.33
	Socioeconomic status	0.01	0.06	1.01	0.90	1.13	0.15	0.88
	TAS x Growth mindset	-0.02	0.06	0.98	0.87	1.10	-0.36	0.72
	TAS x Gender	-0.18	0.17	0.83	0.60	1.15	-1.11	0.27
	Growth mindset x Gender	-0.39	0.21	0.68	0.45	1.02	-1.85	0.06
	TAS x Growth mindset x Gender	-0.22	0.12	0.81	0.63	1.03	-1.75	0.08
Well-adjusted vs. Comorbid	TAS	-0.40	0.04	0.67	0.62	0.73	-9.00	<0.001
	Growth mindset	-0.13	0.05	0.88	0.80	0.96	-2.72	0.01
	Gender [a]	-0.27	0.11	0.76	0.61	0.95	-2.46	0.01
	Age	-0.02	0.04	0.98	0.91	1.06	-0.48	0.63
	Socioeconomic status	-0.05	0.03	0.95	0.90	1.01	-1.55	0.12
	TAS x Growth mindset	-0.01	0.03	0.99	0.92	1.06	-0.38	0.71
	TAS x Gender	0.08	0.09	1.08	0.91	1.28	0.88	0.38
	Growth mindset x Gender	0.03	0.10	1.03	0.86	1.25	0.33	0.74
	TAS x Growth mindset x Gender	-0.17	0.07	0.85	0.74	0.97	-2.44	0.02
Well-adjusted vs. High-risk	TAS	-0.42	0.08	0.65	0.56	0.76	-5.57	<0.001
	Growth mindset	-0.19	0.09	0.83	0.70	0.99	-2.11	0.04
	Gender [a]	-0.61	0.21	0.54	0.36	0.82	-2.91	0.01
	Age	-0.01	0.06	0.99	0.87	1.13	-0.12	0.90
	Socioeconomic status	0.00	0.06	1.01	0.90	1.12	0.09	0.93
	TAS x Growth mindset	-0.14	0.06	0.87	0.78	0.97	-2.49	0.01
	TAS x Gender	-0.25	0.15	0.78	0.58	1.05	-1.65	0.10
	Growth mindset x Gender	-0.10	0.17	0.90	0.64	1.27	-0.58	0.56
	TAS x Growth mindset x Gender	0.02	0.11	1.02	0.82	1.27	0.19	0.85

Note. $N = 1741$. [a] coded as 1 = boys, 2 = girls

With regard to the significant three-way interaction, the results showed that, for boys at both higher and lower levels of growth mindset, the profiles contrast yielded a similar level of significance ($b = -0.51$, $SE = 0.09$, $\beta = 0.59$, 95% CI for β [0.49, 0.71], odds ratio = -5.67, $p < .001$ for lower growth mindset; $b = -0.35$, $SE = 0.07$, $\beta = 0.70$, 95% CI for β [0.60, 0.82], odds ratio = -4.47, $p < .001$ for higher growth mindset); the similar significant results have also found for girls ($b = -0.24$, $SE = 0.08$, $\beta = 0.78$, 95% CI for β [0.66, 0.92], odds ratio = -2.92, $p < .001$ for lower growth mindset; $b = -0.47$, $SE = 0.08$, $\beta = 0.62$, 95% CI for β [0.53, 0.73], odds ratio = -5.65, $p < .001$ for higher growth mindset). From a descriptive point of view (see Fig. 3) and inspection of the values of odds ratio mentioned above, we concluded that, in the context of high teacher autonomy support, girls with higher levels of growth mindset were more likely to be group members of the well-adjusted profile than the comorbid profile; yet, the same trend was not salient for boys.

Discussion

Considering the prevalence of internalizing and externalizing problems in adolescence, the current study examined the association between teacher autonomy support and emotional-behavioral functions using a person-centered approach and investigated the conditional relations of this association by simultaneously incorporating growth mindset and gender as exploratory moderators. The results showed four emotional-behavioral functioning profiles: primarily externalizing, comorbid, well-adjusted, and high-risk. Moreover, adolescents with high teacher autonomy support were more likely to be group members of the well-adjusted profile than the remaining three emotional-behavioral functioning profiles. In addition, interaction analyses showed that girls benefited more when teacher autonomy support and growth mindset were congruently high, whereas boys did not.

The first research aim was to identify emotional-behavioral functioning profiles based on the SDQ. By further

Fig. 2 Interaction effect of teacher autonomy support and growth mindset on probability of profiles contrast between well-adjusted and high-risk. *Note.* $N = 1741$, GM = growth mindset
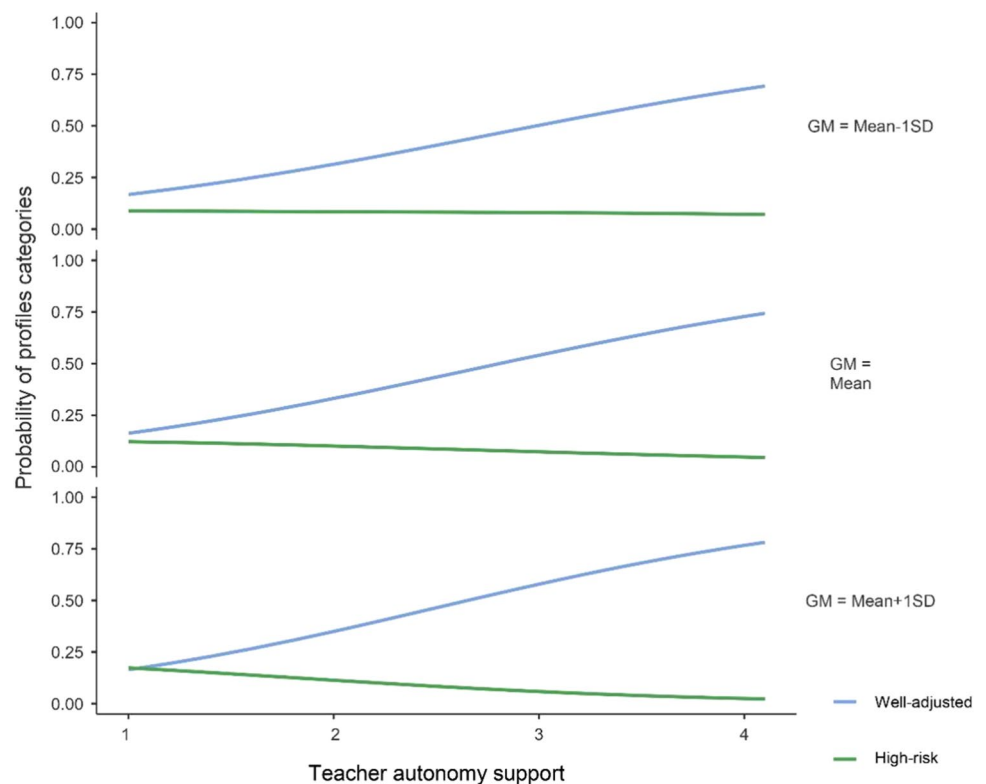

extending prior research, the current study revealed four profiles: primarily externalizing (6.2%), comorbid (32.9%), well-adjusted (53.7%), and high-risk (7.2%). Notably, this finding was inconsistent with prior research on Chinese adolescents (Ling et al., 2016). One explanation might be related to age differences. Compared to Ling et al.'s (2016) research, adolescents in the current study were younger, and during this earlier period of life, symptom presentation is often in flux and demonstrates distinctive varieties. Specifically, in the primarily externalizing profile, adolescents' psychopathological manifestation was characterized by exclusively high levels of externalizing problems, which was in line with prior research such as Muratori et al. (2021). In the comorbid profile, adolescents manifested the mild and similar symptoms of both the internalizing and externalizing domains but yielded relatively low scores in prosocial behavior. This group of adolescents represents the second-largest percentage in the study sample, indicating a high rate of comorbidity between internalizing and externalizing problems due to common underlying features of youth psychopathology (Weiss et al., 1998; Willner et al., 2016). In the well-adjusted profile, adolescents exhibited the lowest levels of difficulty but the highest levels of prosocial strength, representing the largest percentage in the study sample, which corresponds closely to Ling et al.'s (2016) research on Chinese adolescents. However, it is important to note that the current study was centered on a battery of self-reported instruments, and the findings cannot completely

exclude social desirability bias. In the high-risk profile, adolescents had the highest likelihood of experiencing internalizing and externalizing problems simultaneously, although internalized distress seemed to be the main feature of this profile. Surprisingly, this group of adolescents also reported an average prosocial behavior level. One explanation could be Chinese cultural values. In this cultural context, adolescents are socialized to be prosocial, as it is conducive to interdependence and group harmony (Bond, 2010; Lan & Wang, 2020).

The second research aim was to examine the association between teacher autonomy support and adolescents' emotional-behavioral functions and their conditional processes. In line with the initial expectation, the current findings exhibited that adolescents with high levels of teacher autonomy support were more likely to be group members of the well-adjusted profile than the three remaining profiles. This finding further enriches self-determination theory (Deci & Ryan, 2012) and prior research documenting that teacher autonomy support plays a crucial role in adolescents' optimal emotional-behavioral functions in a collectivistic cultural context (Lan & Zhang, 2019; Yu et al., 2016). One possible explanation is that in recent years, new generations have increasingly advocated for autonomy, likely due to the dramatic development of Chinese economy and corresponding sociocultural changes (Yu et al., 2016). Indeed, facilitating autonomy is especially valued at school, where students are encouraged to express their personal opinions

Fig. 3 Interaction effect of teacher autonomy support, growth mindset, and adolescents' gender on probability of profiles contrast between well-adjusted and comorbid. *Note.* *N* = 1741, GM = growth mindset
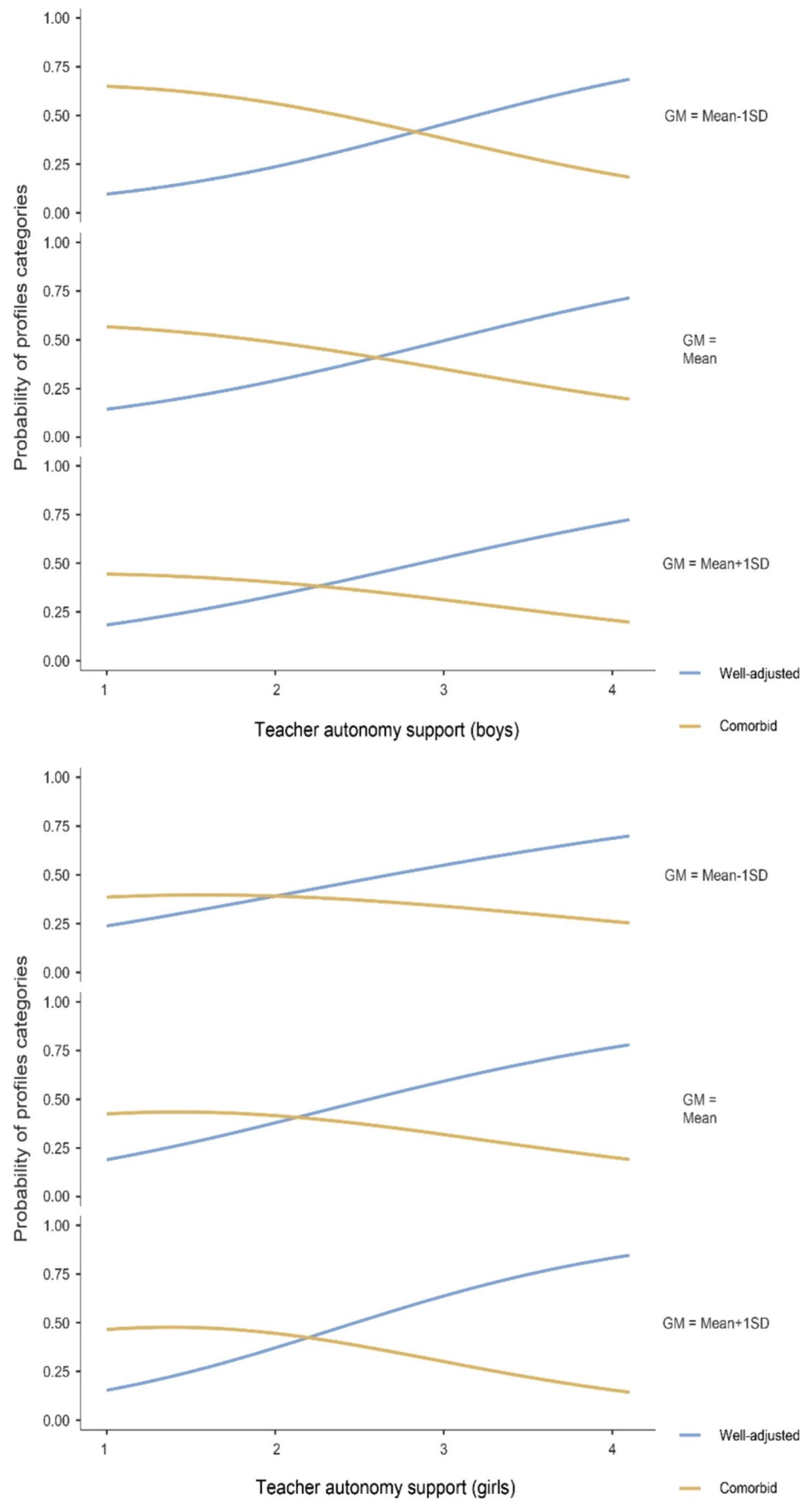
and cultivate their self-confidence to improve their potential future careers in an environment of increasingly fierce social competition (Yu et al., 2016). Moreover, adolescents spend most of their time at school, and they have broad contact with head teachers, whose primary responsibilities include discipline, supervising their emotional regulation skills and behavioral modifications (Feng & Li, 2016; Lan & Zhang, 2019), and immediately recognizing their psychological needs while also providing timely guidance. By stimulating adolescents' inner motivation and inducing adaptive behaviors, teacher autonomy support can improve adolescents' confidence in emotional-behavioral regulation and deter them from problematic performance at school.

Furthermore, interaction analyses showed that high levels of growth mindset significantly increased the likelihood of being well-adjusted over being high-risk in the context of high (instead of low) levels of teacher autonomy support. This is different from previous studies that highlight the buffering role of a growth mindset in the context of adverse environmental processes (Burnette et al., 2013; Claro et al., 2016; Niu et al., 2020). One plausible explanation is that most of the previous studies that yielded this finding were focused on the association of the growth mindset toward intelligence with motivation and achievement, which is unlike the current focus. Adolescents with strong levels of growth mindset may be more open to transformational relationships with their teachers (e.g., encouragement of independence, volitional functioning, and psychological freedom). These adolescents may understand that teacher autonomy support is geared toward their personal growth and would eventually benefit them (Caniëls et al., 2018). Consequently, they are more likely to report low problematic behaviors but high prosocial strengths (Deci & Ryan, 2012; Vansteenkiste et al., 2012).

In addition, the three-way interaction indicates that contextual and individual assets are essential for adolescents' optimal emotional-behavioral functions, but gendered pathways should be considered. Specifically, girls benefited more than boys from congruently high teacher autonomy support and growth mindset. One explanation could be that girls often outperform boys in terms of academic grades (Hamre & Pianta, 2001) and show fewer externalizing behaviors at school (Thijs et al., 2015). Thus, girls often keep closer relationships with their teachers, whereas boys mostly receive help and attention when in at-risk situations. Following this line of argument, teachers may show more autonomy support to girls and be more critical and controlling of boys. The current study also reflected this gender difference, as girls reported significantly higher levels of teacher autonomy support than boys. At the same time, girls may be more sensitive to social interactions, including teacher-student relationships, and strong levels of growth mindset toward personality can make them very flexible in any conflicts during

teacher-student interactions. Another important factor that may explain this difference is the divergent socialization of the sex role (Cui & Lan, 2020). Girls are educated to care more for others emotionally and use adaptive and flexible emotion regulation strategies in case of potential conflicts (Nolen-Hoeksema & Aldao, 2011). Therefore, congruently high teacher autonomy support and growth mindset levels could significantly facilitate girls' optimal functions. Compared to girls, the type of discipline boys receive is more firm and decisive. Other individual assets, such as perseverance, may be crucial to boys in this perspective.

Although the current study is pioneering in its investigation of the associations of teacher autonomy support, growth mindset, and adolescent gender with emotional-behavioral functioning profiles, the study also involved a few limitations that should be considered for future research. First, the current study heavily relied on self-report measurements, and thus common method variance and social desirability may have inflated or deflated study associations (Podsakoff et al., 2003). This is particularly pressing for externalizing problems, as they might be more accurately observed and assessed by external informants, such as teachers and parents. Second, adolescents in the current study were recruited from a single cultural context, and thus the findings yielded may be limited in terms of how they can be generalized across different populations under distinct cultural contexts. Third, the current study was conducted cross-sectionally; thus, the directionality of study associations cannot be inferred.

Conclusions

The current study, grounded in the socio-ecological framework, aims to create a comprehensive and systematic understanding of how teacher autonomy support, growth mindset, and gender independently and jointly shape adolescents' emotional-behavioral functions. The findings obtained provide novel insights for educators and practitioners to facilitate students' optimal functions at school. First and foremost, the current study expands the body of research that employs a person-centered approach to understand adolescents' emotional-behavioral functions, which has important and specific implications for designing personalized intervention or prevention programs based on their developmental assets and deficits. Moreover, the current study contributes to the extant research on the beneficial role of teacher autonomy support in facilitating optimal emotional-behavioral functions of adolescents in a collectivistic cultural context. Teachers should be equipped with sufficient skills and training to maintain an autonomy-supportive classroom climate. Additionally, the elicited moderating role of the growth mindset in the association under investigation proffers a

new avenue by which school-based activities or efficacious interventions could aid adolescents to function adaptively, although distinctly gendered pathways for these activities or programs should be carefully considered.

Data Availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Conflict of Interest The author has no conflicts of interest to declare.

Informed Consent All procedures performed in studies involving human participants were by the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all participants included in the present study.

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