

# The Relations of Temperamental Effortful Control and Anger/Frustration to Chinese Children's Academic Achievement and Social Adjustment: A Longitudinal Study

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The prospective relations of temperamental effortful control and anger/frustration to Chinese children's ( $N = 425$ , age range = 6.6–9.1 years) academic achievement (grade point average, or GPA) and social adjustment (externalizing problems and social competence) were examined in a 2-wave (3.8 years apart) longitudinal study. Parents and teachers rated children's temperament, and parents, teachers, and/or peers rated children's externalizing problems and social competence. Effortful control positively predicted children's GPA, controlling for prior level of GPA. Analyses examining the potential mechanisms underlying the temperament–achievement associations suggested that effortful control positively predicted social competence, and social competence positively predicted GPA. Moreover, anger/frustration positively predicted externalizing problems, and externalizing problems negatively predicted GPA. Mediation analyses suggested that the relations between temperament and GPA were mediated by social competence and externalizing problems. Evidence for the reciprocal relations between externalizing problems and GPA was also found. The study suggested that there are complex interplays among temperament, academic achievement, and social adjustment for school-age children.

*Keywords:* temperament, academic achievement, Chinese children

Effortful control and anger/frustration are two temperament characteristics that have been associated with a wide range of adjustment outcomes in children and adolescents, including behavioral problems, social competence, and moral and conscience development (Eisenberg & Morris, 2002; Rothbart & Bates, 2006). *Effortful control* is defined as “the efficiency of executive attention, including the ability to inhibit a dominant response, to activate a subdominant response, to plan, and to detect errors” (Rothbart & Bates, 2006, p. 129). It is a multidimensional construct including various capacities such as the voluntary focusing of attention (e.g., concentrate when studying) and suppressing inappropriate responses (e.g., lower voice when asked to) (Derryberry & Rothbart, 1997; Rothbart & Bates, 2006). *Anger/frustration* refers to the negative emotionality associated with the interruption of ongoing tasks or goal blocking (Rothbart, Ahadi, Hershey, & Fisher, 2001). In the present study, we sought to understand the

relations between these two components of temperament and academic achievement in Chinese children. In addition, we examined whether children's externalizing problems (i.e., aggression and rule breaking/delinquent behaviors such as hitting or arguing; Achenbach, 2001) and social competence mediated the relations between temperament and academic achievement.

Despite the theoretical proposal that individual differences in emotion regulation and emotionality play a crucial role in children's school readiness and academic success (Blair, 2002), there have been few longitudinal studies of the link between temperament and children's academic achievement. Even fewer researchers have examined the mechanisms underlying the relations between temperament and academic achievement. Using two waves (3.8 years apart) of longitudinal data, we investigated the prospective relations of effortful control and anger/frustration to children's academic achievement (assessed as grade point average [GPA]) in a sample of urban Chinese elementary school students. We also tested two hypotheses regarding the mechanisms underlying the temperament–achievement association: (a) Temperament predicts externalizing problems and social competence, which in turn predicts academic achievement, and (b) temperament predicts children's academic achievement, which in turn predicts externalizing problems and social competence. Because the present study was conducted in mainland China, a country that places high emphasis on children's academic success, and its education system differs in several ways from that in the North American countries, the study provided a test of the generalizability of developmental theories on temperament, academic achievement, and social development to a non-Western culture.

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## Effortful Control and Anger/Frustration: Relations to Academic Achievement

### Effortful Control

Effortful control is hypothesized to positively predict children's academic achievement through multiple mechanisms. First, through the *cognitive mechanisms*, children with high effortful control are expected to be better at focusing, sustaining, and shifting attention as well as inhibiting prepotent responses as needed. These are key cognitive skills involved in major academic tasks for school-age children (e.g., reading, writing, and solving math problems) (Blair & Razza, 2007; Posner & Rothbart, 2007). Second, through the *motivational mechanisms*, children with high effortful control are expected to be better at initiating, sustaining, and regulating their motivation and engagement in goal-directed activities, including academic learning (Rothbart & Jones, 1998). Indeed, children with high effortful control have shown greater persistence in structured tasks (Zhou et al., 2007), greater degrees of school liking, fewer school absences, and higher degrees of classroom participation (Valiente, 2008; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008). Third, through the *emotion regulation mechanisms*, in which children with high effortful control are expected to be more successful at regulating their negative emotions and behavioral impulses (e.g., disruptive behaviors) in structured classroom settings, which may facilitate effective learning and promote academic achievement (Blair, 2002; McClelland et al., 2007). Fourth, through the *interpersonal mechanisms*, in which children with high effortful control are expected to be more successful at developing and maintaining positive social relationships (e.g., teacher–student relationship, peer relationship) (Graziano, Reavis, Keane, & Calkins, 2007; Valiente et al., 2008), which in turn may facilitate learning and academic success (e.g., Hamre & Pianta, 2001; Ladd, 2003; Wentzel, 1991; Wentzel & Asher, 1995). Consistent with the above theories, components of effortful control (e.g., attention regulation, emotion regulation, and inhibitory control) were found to predict children's academic achievement in reading, mathematics, and linguistic abilities during early school years (see Eisenberg et al., 2005, for a review; see also Blair & Razza, 2007; Hill & Craft, 2003; Howse, Lange, Farran, & Boyles, 2003; Valiente et al., 2008).

### Anger/Frustration

Consistent with the hypothesis that the children with high anger/frustration experience more difficulty in regulating their emotional arousal and emotion-related behaviors, effortful control and anger/frustration have been negatively related with each other (e.g., Derryberry & Rothbart, 1988; Zhou, Eisenberg, Wang, & Reiser, 2004; Zhou et al., 2008). Similar to effortful control, anger/frustration is expected to predict children's academic achievement through several mechanisms. The first is the *cognitive mechanism*, in which children with high negative emotionality, including anger/frustration, are expected to experience difficulty in applying higher order cognitive processes such as strategic thinking, memory, attention, and problem solving (which are often involved in academic tasks in mathematics and reading), because "their emotional response does not call for reflective planning and problem solving, and these skills are underused and consequently underde-

veloped" (Blair, 2002, p. 119). In support of this perspective, the children who watched a sad film showed deficits in their ability to recall subsequent educational materials than children who watched a neutral film (Rice, Levine, & Pizarro, 2007). Moreover, the experience of unpleasant affect, including anger, was associated with college students' decreased working memory and lower level of conceptual change (Linnenbrink, 2007). The second is the *interpersonal mechanism*, in which children with high anger/frustration are expected to encounter more difficulties in interpersonal relationships at school (e.g., peer rejection and victimization; Dougherty, 2006), which in turn impair their academic performance. The third is the *motivational mechanism*, in which children with high anger/frustration are expected to have lower motivation and engagement in academic tasks. Linnenbrink (2007) theorized that the experience of unpleasant affect might undermine students' behavioral engagement in learning. Indeed, children with high anger levels showed lower motivation for on-task performance (Heavey, Adelman, Nelson, & Smith, 1989). There is a growing literature on the role of affective state (mood) in children's learning and academic development (Schutz & Pekrun, 2007). However, very few researchers have studied the relation of temperament anger/frustration, or negative emotionality to children's academic achievement. One exception is that test anxiety (a different form of negative affect that also has a dispositional or temperament root) has been negatively related to children's academic performance (Zeidner, 1998). Among the few studies in which temperament anger or negative emotionality and achievement have been examined, the results have been inconsistent. For example, although negative emotionality was negatively related to children's GPA in one study (Gumora & Arsenio, 2002), it was unrelated to GPA or academic functioning in two other studies (Boekaerts, 1993; Supplee, Shaw, Hailstones, & Hartman, 2004). The lack of consistent relations between anger/frustration and academic achievement is likely because the anger–achievement relation depends on other factors. For example, several researchers have suggested that effortful control might moderate the relation between negative emotionality (including anger) and children's adjustment outcomes (e.g., Eisenberg et al., 1996; Oldehinkel, Hartman, Ferdinand, Verhulst, & Ormel, 2007). To our knowledge, there has been no longitudinal research examining the relations of temperament and anger/frustration (a specific type of negative emotionality) to children's academic achievement.

In summary, the above review supports the hypotheses that temperamental effortful control would positively predict and anger/frustration would negatively predict changes in academic achievement, although the empirical evidence appears to be stronger for effortful control than for anger/frustration. However, not all studies used the longitudinal design and controlled for baseline academic achievement when predicting academic achievement from temperament (e.g., Hill & Craft, 2003). Moreover, the majority of studies focused on preschool to early elementary school periods. Thus, it is unclear whether the influence of temperament on children's academic achievement persists into the late elementary school period. In addition, because the majority of research in this area was based on samples in North America (although a few studies included ethnic minority children in the United States; e.g., Hill & Craft, 2003; Valiente, Lemery-Chalfant, & Castro, 2007; Valiente et al., 2008), it remains a question whether the hypothesized relations between temperament and academic achievement

can be generalized to child samples from countries with somewhat different cultural values and educational systems.

### Academic Achievement in Chinese Children: The Roles of Temperament

Very few researchers have examined the relations of temperament to Chinese children's academic achievement. Consistent with the positive values toward shy, inhibited, and reserved behaviors in the Chinese society, temperament shyness has been positively related to Chinese children's academic achievement, which was opposite of the findings from Western samples (e.g., Chen, Rubin, & Li, 1995, 1997). However, to our knowledge, no study has examined the links of temperamental effortful control and anger/frustration to Chinese children's academic achievement.

Academic achievement has long been highly valued in the Chinese society (Phelps, 2005). In ancient China, succeeding the imperial examination was a main avenue to a prospective career for individuals from lower to middle-class families. In modern China, due to the limited opportunities to receive higher education, passing the National College Entrance Examination and obtaining a college degree is considered a key prerequisite for competing for advanced career opportunities. Thus, from an early age, Chinese children come to understand the importance of academic achievement. Moreover, in Chinese society, academic achievement is viewed not only as an indicator of individual success but also as a filial duty to the entire family (Salili & Lai, 2003).

To understand how effortful control and anger/frustration influence Chinese children's academic achievement, it is important to consider the learning environment in Chinese schools. Several characteristics have been observed in the early educational contexts in China in comparison to schools in North America. First, Chinese classrooms tend to have high student-teacher ratios (Phelps, 2005). Second, Chinese teachers engage in more group teaching and less individual teacher-student interaction than North American teachers. For example, in Chinese classrooms, learning is primarily achieved through the teacher's lecturing and querying, and seatwork exercises. Students are expected to pay undivided attention to the teacher, respond to queries, be attentive and respectful when classmates present, and complete seatwork in a timely and appropriate fashion (Peng, 1993; Phelps, 2005). Third, Chinese teachers place greater emphasis on students' obedience to authority and self-regulation than self-expressiveness and assertiveness (Peng, 1993; Phelps, 2005). In addition, students' academic success tends to be attributed to effort rather than to ability in China (Phillipson, 2006). In such as a group-based, highly structured, and effort-emphasized learning environment, the students with low effortful control of attention, motivation, and behaviors would be expected to have poorer academic achievement than those with high effortful control. Moreover, consistent with the collective cultural emphasis on harmonious interpersonal relationship (Markus & Kitayama, 1991), anger/frustration is often thought to reflect a lack of self-control, inattentiveness to group norms, and inappropriate emotional expression in the Chinese context. Thus, the Chinese children with high anger/frustration are expected to have poorer academic achievement than their peers. Therefore, despite the cultural differences in educational contexts, the *direction* of the association between effortful control and academic achievement in China is expected to be similar to the

relations found in North America. In fact, due to the greater emphasis on self-regulation of attention, negative emotions, and behavioral impulses in Chinese classrooms, one might expect that the positive association between effortful control and academic achievement and the negative association between anger/frustration and academic achievement would be stronger in a Chinese sample than in North American samples. Indeed, in a cross-cultural comparative study, Zhou, Lengua, and Wang (in press) found that the associations between anger or effortful control and externalizing problems were stronger in the Chinese sample than in the U.S. sample. Because a directly comparable North American sample was not available for the present study, cross-cultural comparisons on the strength of associations between temperament and achievement could not be conducted. However, we can at least test whether the direction of the associations in the Chinese sample are similar to or different from previous findings with North American samples.

The first goal of the present study was to examine the prospective relations of temperament effortful control (assessed as parents' and teachers' ratings of attention focusing and inhibitory control) and anger/frustration to Chinese children's GPA. As described in Figure 1, we hypothesized that controlling for baseline GPA, effortful control in early elementary school would positively predict Chinese children's GPA in late elementary school. We expected that anger/frustration would negatively predict Chinese children's GPA, although the relation might be weaker than for effortful control.

### Children's Social Competence and Externalizing Problems as Mediators in the Temperament-Academic Achievement Relations

The second goal of the study was to further understand the roles of effortful control and anger/frustration in children's academic development by examining the mechanisms that might mediate the temperament-achievement associations. Specifically, we were interested in children's social competence and externalizing problems as two potential mediators.

#### Social Competence

Eisenberg et al. (2005) hypothesized that the relation between children's effortful control and academic competence might be partly mediated by social competence. Indeed, effortful control has been positively related to children's constructive social interactions with peers, social skills, and popularity (e.g., Eisenberg, Fabes, Guthrie, & Reiser, 2000; Fabes et al., 1999; Spinrad et al., 2006). In contrast, anger emotionality has been negatively related to children's prosocial orientation (Rydell, Berlin, & Bohlin, 2003) and competent peer interactions (Fabes et al., 1999). Moreover, children with better social relationships at school might have higher motivation in schoolwork and thus perform better academically (Furrer & Skinner, 2003). Indeed, prospective positive relations have been found between children's prosocial behavior, peer acceptance, or social competence and academic competence in math, language, or reading in both European American (e.g., Ladd, 2003; Welsh, Parke, Widaman, & O'Neil, 2001) and Chinese samples (e.g., Chen, Chang, Liu, & He, 2008; Chen et al., 2002; Chen et al., 1997), suggesting that social competence and aca-

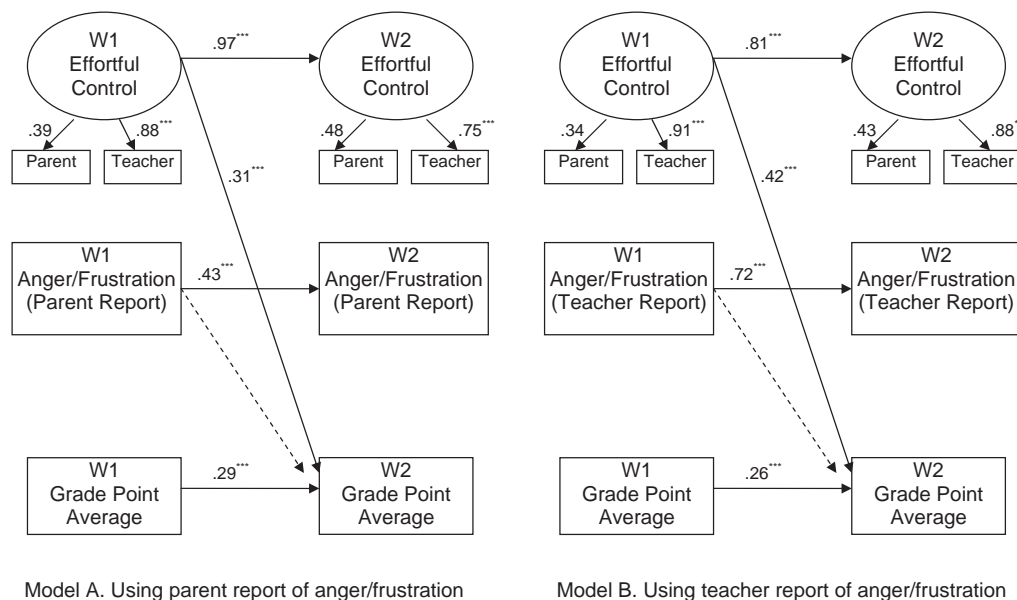


Figure 1. The preliminary models predicting grade point average (GPA) from temperament. The numbers in the figure are standardized loadings or correlation coefficients. The dotted lines represent nonsignificant loadings or correlations, solid lines represent significant loadings or correlations. \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

ademic achievement are closely related in both the Western and Chinese cultures.

In summary, we hypothesize that the Chinese children with high effortful control or low anger/frustration develop higher social competence over time, which in turn promotes their academic achievement. Only one study directly tested the above hypothesis and found that social competence mediated the relation between effortful control and European American and Mexican American children's GPAs across a 1-year period (Valiente et al., 2008). As shown in Figure 2, although the full mediational pathway (Wave 1 [W1] temperament  $\rightarrow$  W2 social competence  $\rightarrow$  W3 GPA) cannot be examined in the present study because only two waves of panel data were available, we can estimate the path from W1 temperament to W2 social competence, controlling for W1 social competence (Path a), and the path from W1 social competence to W2 GPA, controlling for W1 GPA (Path b). As suggested by Cole and Maxwell (2003), if we can assume that the path from W1 social competence to W2 GPA would be equal to the path from W2 social competence to W3 GPA (i.e., the stationarity assumption), the product of Path a and Path b provides an estimate of the mediational effect of temperament on GPA through social competence. This approach of testing mediation is less biased than approaches typically applied to the half longitudinal design (e.g., testing the pathway of W1 temperament  $\rightarrow$  W2 social competence  $\rightarrow$  W2 GPA) (Cole & Maxwell, 2003). Therefore, after testing the hypothesized models, the significance of the mediated effect (temperament  $\rightarrow$  social competence  $\rightarrow$  GPA) was tested.

In addition, some researchers suggested that social competence and academic achievement are reciprocally related, such that the children with higher social competence do better academically, and the children with higher academic achievement develop higher social competence over time (Chen et al., 2008, 1997; Welsh et al., 2001). Therefore, we also tested the alternative model, in which

effortful control or anger/frustration predicts children's academic achievement, which in turn predicts social competence (see Figure 3). Furthermore, the significance of the mediated effect (temperament  $\rightarrow$  GPA  $\rightarrow$  social competence) was tested.

### Externalizing Problems

Similarly, externalizing problems might also mediate the temperament-academic achievement relations. Empirical evidence for low effortful control or high anger/frustration as risk factors for externalizing problems has been obtained in both the Western (e.g., Calkins & Dedmon, 2000; Eisenberg et al., 2001, 2005; Kochanska & Knaack, 2003; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005) and Chinese cultures (e.g., Eisenberg et al., 2007; Zhou et al., 2004; Zhou et al., 2008). Moreover, the co-occurrence between academic underachievement and externalizing problems in school-age children has been widely documented (see Hinshaw, 1992, for a review). Recent studies suggested that the academic achievement (especially in reading or literacy)-externalizing problems relation is primarily due to the reciprocal influences of achievement and externalizing problems upon each other over time (Miles & Stipek, 2006; Stipek & Miles, 2008; Trzesniewski, Moffitt, Caspi, Taylor, & Maughan, 2006). These results supported the theory that academic failure results in anger, frustration, and other unpleasant emotions, which motivate aggressive behaviors (Berkowitz, 1993). Moreover, academic failure might cause children to dislike school and normal peers and become affiliated with deviant peers whose norms promote externalizing problems (Sher, 1991). Alternatively, externalizing problems might precede and cause academic underachievement because externalizing behaviors might cause conflict in interpersonal relationships (e.g., teacher-child conflict, Stipek & Miles, 2008) and interfere with children's school engagement (e.g., aggressive children pay less



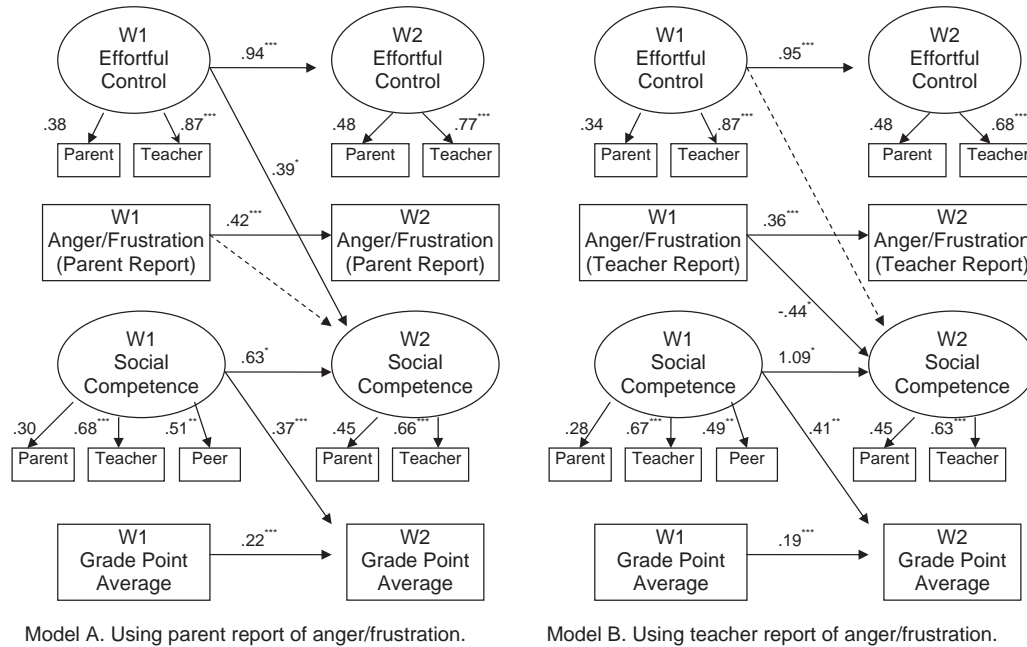


Figure 2. The models testing social competence as a mediator in the temperament–grade point average (GPA) associations. The numbers in the figure are standardized loadings or correlation coefficients. The dotted lines represent nonsignificant loadings or correlations, solid lines represent significant loadings or correlations. \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

attention to, spend less time on, and efforts in academic work, enjoy school less, and feel less connected to classmates and teachers; Arnold, 1997; Coie & Dodge, 1988; Hoglund, 2007).

Similar to social competence, two sets of hypothesized models were proposed for externalizing problems: (a) the models in which low effortful control or high anger/frustration predicts high externalizing problems, and high externalizing problems predicts low GPA (see Figure 4); and (b) the models in which low effortful control or high anger/frustration predicts low GPA, and low GPA predicts high externalizing problems (see Figure 5). After testing the hypothesized models, the significance of the mediated effects (i.e., temperament  $\rightarrow$  externalizing problems  $\rightarrow$  GPA, and temperament  $\rightarrow$  GPA  $\rightarrow$  externalizing problems) were tested.

In summary, the study has two goals: (a) to examine the prospective relations of effortful control and anger/frustration to Chinese children's academic achievement and (b) to examine the roles of social competence and externalizing problems as potential mediating mechanisms underlying the temperament–achievement associations. Specifically, two types of models were tested: the models in which temperament predicts social competence or externalizing problems, which in turn predicts academic achievement, and the models in which temperament predicts academic achievement, which in turn predicts social competence or externalizing problems.

## Method

### Participants

Participants were children, their parents, and teachers from a two-wave (3.8 years apart) longitudinal study in Beijing, China

(see Zhou et al., 2004, 2008, for detailed description of the sample). At W1 (summer 2000), 425 first and secondgrade children (55.5% girls, mean age = 7.7 years,  $SD = 0.6$ , age range = 6.6–9.1 years) were recruited from 14 classrooms in two public elementary schools. Of these children, 49% were first graders, and 91% were the only children in the family. The percentages of children from two-parent, extended (including parents and grandparents or other family members), or single-parent families were 75%, 22%, and 3%, respectively. The sample included primarily low- to middle-income families based on the demographic statistics of urban Beijing (National Bureau of Statistics of China, 2000). Similar to other public elementary schools in urban China, both participating schools have Grades 1 through 6, with a total of 28–34 classrooms and 1,100–1,300 students.

At W2 (spring 2004), 382 children (52.9% girls, mean age = 11.6 years,  $SD = 0.6$ , age range = 10.1–12.9) from this sample were reassessed (retention rate = 89.9%) when they were in fifth (50%) or sixth grade. The percentages of children from two-parent, extended, or single-parent families were 79.2%, 16.7%, and 4.1%, respectively. Attrition analyses suggested that compared with the children who were assessed at both W1 and W2 ( $N = 382$ ), those who only completed the W1 assessment ( $N = 43$ ) had higher parental education and family income.

### Procedure

An introduction letter and a permission form were handed out to the parents of all the first and second graders at W1 ( $N = 589$ ) or fifth and sixth graders at W2 ( $N = 387$ ) at the two schools. At W1, 425 parents (72%) and at W2, 382 parents (99%) provided written consent. The data were collected through questionnaires completed

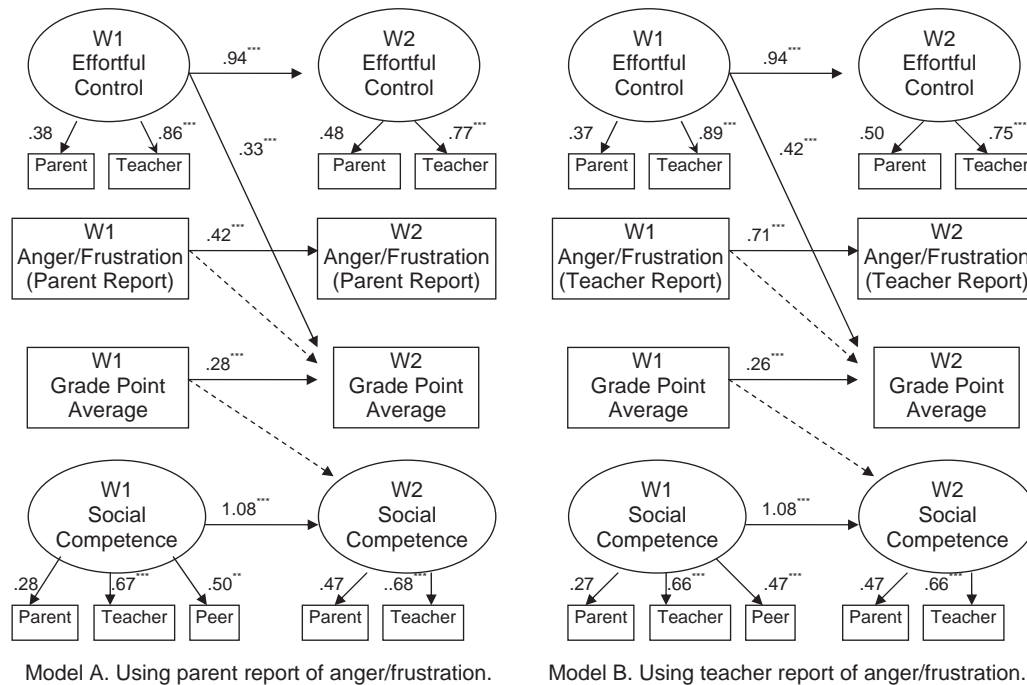


Figure 3. The models testing grade point average (GPA) as a mediator in the temperament–social competence associations. The numbers in the figure are standardized loadings or correlation coefficients. The dotted lines represent nonsignificant loadings or correlations, solid lines represent significant loadings or correlations. \*\* $p < .01$ . \*\*\* $p < .001$ .

by parents, teachers, and children. The return rates for teachers were 98.9% at W1 ( $N = 420$ ) and 97.9% at W2 ( $N = 374$ ). At both waves, questionnaires were group administered to the children by two research assistants after the children completed written assent forms. The parents and teachers were paid for their participation, and the children were given a small gift.

## Measures

Measures that had not been used in Chinese samples in previous research (i.e., the measure for socially appropriate behaviors) were forward- and back-translated by Chinese speakers who are fluent in both Chinese and English. Translators received assistance from English-speaking researchers for clarifications regarding difficult-to-translate items. A small ( $Ns = 9$  and  $50$  at W1 and W2, respectively) pilot study was conducted to see whether Chinese parents and children had difficulties understanding and responding to the items. The majority of children and parents in the pilot study did not report any difficulty understanding and completing the questionnaires.

### Child Temperament (W1 and W2)

**Effortful control.** Children's effortful control was rated (from  $1 = \textit{extremely untrue of my/this child}$  to  $7 = \textit{extremely true of my/this child}$ ) by parents and teachers using two subscales from the Chinese version of Rothbart's Child Behavioral Questionnaire (CBQ; Goldsmith & Rothbart, 1991; Rothbart et al., 2001): (a) the 12-item Inhibitory Control subscale (11 items for parents' reports and nine items for teachers' reports), which assesses children's

ability to regulate his or her behavior (e.g., "Can lower his/her voice when asked to do so"); and (b) the Attention Focusing subscale (11 items for parents' reports and 10 items for teachers' reports), which assesses children's ability to concentrate on a task when needed (e.g., "When drawing or reading a book, shows strong concentration"). One item from the parent-reported Inhibitory Control subscale ("Approaches places s/he has been told are dangerous slowly and cautiously") had a negative item-total correlation at W2, and thus this item was dropped at both waves to maintain cross-time consistency of the instrument. The negative item-total correlation might be due to the fact that the Chinese translation of this item is somewhat awkward and thus might be difficult for parents to respond to. One item from the teacher-reported Attention Focusing subscale ("Has difficulty leaving a project s/he has begun") had a negative item-total correlation at W1, and thus this item was dropped at both waves. The negative item-total correlation might be due to the fact that this item is negatively worded and thus might be difficult for teachers to respond to. The alphas were .64 and .62 for parents' reports of inhibitory control (10 items) at W1 and W2, respectively, .89 and .88 for teachers' reports (nine items), .77 and .74 for parents' reports of attention focusing (11 items), and .93 and .91 for teachers' reports (10 items).

Consistent with the perspective that inhibitory control and attention focusing are two theoretically and empirically salient components of effortful control (Rothbart & Bates, 2006), at both W1 and W2, the Inhibitory Control and Attention Focusing subscales were moderately to highly correlated within reporters,  $r_{s(401 \text{ and } 419)} = .41$  and  $.78$ ,  $ps < .001$ , for parents' and teachers' reports

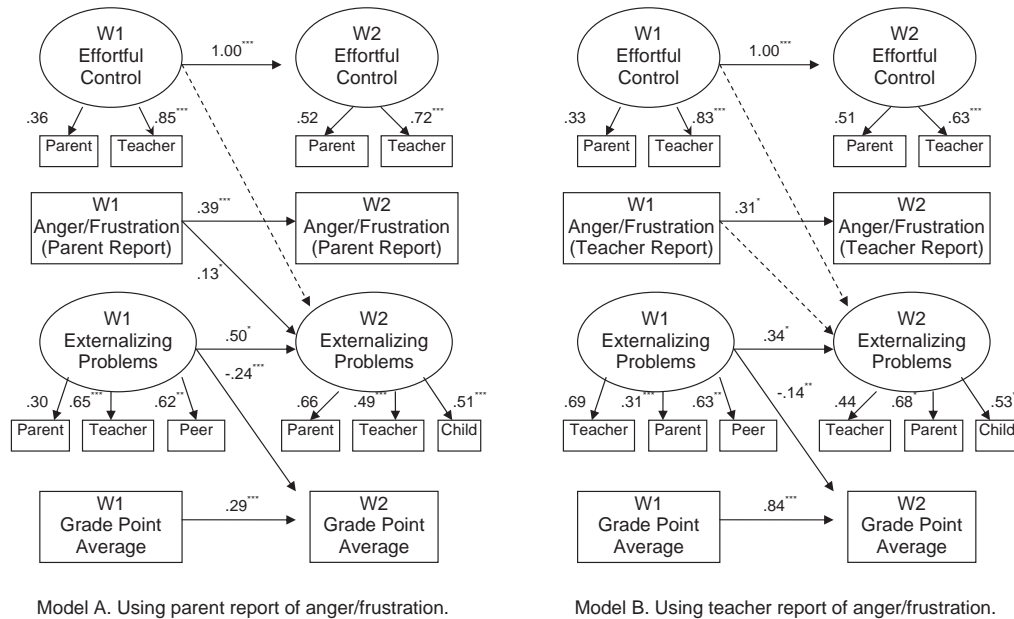


Figure 4. The models testing externalizing problems as a mediator in the temperament–grade point average (GPA) associations. The numbers in the figure are standardized loadings or correlation coefficients. The dotted lines represent nonsignificant loadings or correlations, solid lines represent significant loadings or correlations. \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

at W1, respectively;  $r_s(589 \text{ and } 594) = .52 \text{ and } .80, p_s < .001$ , at W2. Thus, to reduce the number of variables included in the main analyses, at both waves and for both parents' and teachers' reports, an effortful control composite was computed by averaging the two subscale scores. This data reduction approach is supported by empirical work on the factor structure of effortful control (Rothbart et al., 2001) and commonly used by other research groups (e.g., Blair & Razza, 2007; Valiente et al., 2008). The alphas for the combined 25-item parent- and 23-item teacher-report scales were .78 and .95 at W1 and .77 and .94 at W2, respectively.

**Anger/frustration.** Anger/frustration was assessed with the Anger/Frustration subscale from the CBQ (11 items for both parents' and teachers' reports), which assesses the amount of the child's negative affect related to interruption of ongoing tasks or goal blocking (e.g., "Has temper tantrums when s/he doesn't get what s/he wants"; "Gets mad when even mildly criticized"). One item from the parent-reported scale ("Rarely protests when another child takes his/her belongings away") had a negative item-total correlation at W2, and thus this item was dropped from the parent scale at both waves; one item from the teacher-reported scale ("Rarely gets irritated when s/he makes a mistake") was dropped from the teacher scale at both waves due to a negative item-total correlation at W1. The negative item-total correlations might be due to the participants' difficulties in responding to items that were negatively worded.<sup>1</sup> The alphas for the parents' reports of anger/frustration (10 items) were .69 and .68 at W1 and W2, and .were .88 and .87 for teachers' reports (10 items). At both waves and for both reporters, the item scores were averaged to obtain the anger/frustration composite.

**Externalizing problems (W1 and W2).** At W1, parents ( $\alpha = .87$ ) and teachers ( $\alpha = .96$ ) rated children's externalizing problems

(from 1 = *never* to 4 = *often*) on the 24-item Child Behavior Checklist (CBC; Lochman & Conduct Problems Prevention Research Group, 1995; e.g., "argues," "lies," "aggressive to adults"). Peer nominations of aggressive/disruptive behaviors were obtained using the Agression subscale (seven items, e.g., "Somebody who gets into lots of fights") from the Chinese version of the Revised Class Play (RCP; Masten, Morison, & Pellegrini, 1985; see also Chen, Rubin, & Sun, 1992). In the classroom, children were provided a form containing the 21 behavioral descriptors and a list of the names of all students in the class. After the research assistant read each descriptor, children nominated up to three classmates who could best play the role if they were to direct a class play. Nominations of all classmates were used to compute each item score for each child. The item scores were standardized within the class to adjust for differences in the number of nominators. A composite ( $\alpha = .92$ ) was computed by averaging the corresponding item scores.

At W2, parent-, teacher-, and child-reported externalizing problems were assessed with the Child Behavioral Checklist (CBCL; Achenbach, 2001), Teacher Report Form (TRF; Achenbach, 2001), and Behavior Problem Index (Peterson & Zill, 1986). The CBCL and TRF externalizing scales include two subscales: (a) Rule-Breaking Behav-

<sup>1</sup> To examine whether dropping the negatively worded items has changed the analyses, we compared the zero-order correlations between the temperament and other variables using the composites with or without eliminating those items. The changes in correlation coefficients as a result of eliminating the negatively worded items were small (the absolute values of change ranged from .00 to .08). Therefore, eliminating the negatively worded items that had negative item-total correlations did not change the analysis results.

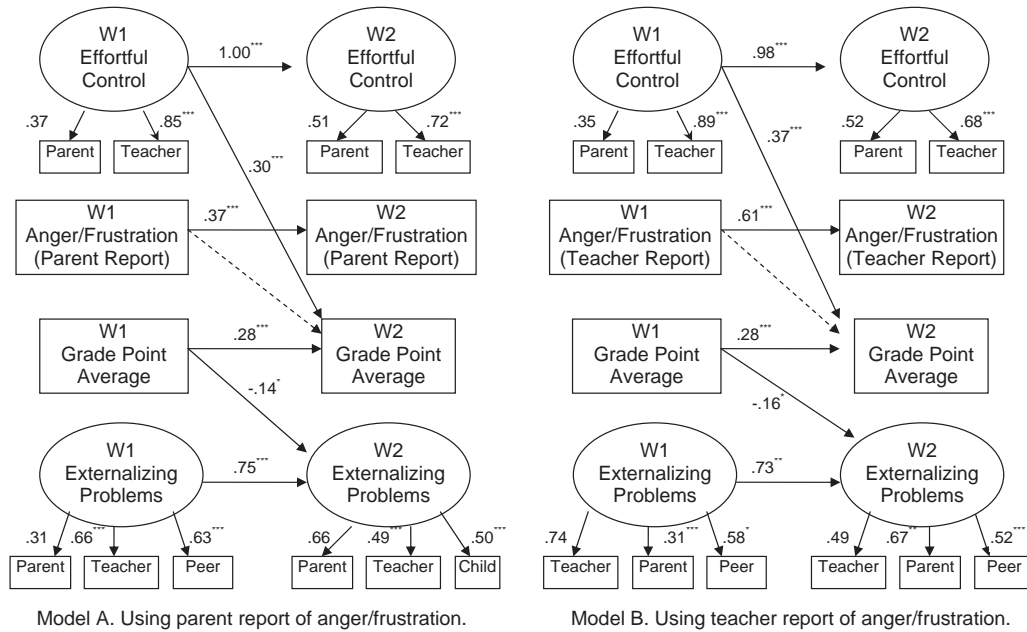


Figure 5. The models testing grade point average (GPA) as a mediator in the temperament–externalizing problems associations. The numbers in the figure are standardized loadings or correlation coefficients. The dotted lines represent nonsignificant loadings or correlations, solid lines represent significant loadings or correlations. \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

iors and (b) Aggressive Behaviors. The BPI Externalizing Scale includes 11 items, all of which are represented in the CBCL and TRF externalizing scales. Scale scores for externalizing problems were computed by averaging the raw scores across the items; the alphas for parents', teachers', and children's reports of externalizing problems were .84, .92, and .76, respectively.

### Social Competence (W1 and W2)

**Socially appropriate behavior.** At both waves, parents and teachers completed a four-item subscale from the adapted version of Harter's Perceived Competence Scale for Children (HPCSC; Harter, 1979; see also Eisenberg et al., 1995), which assesses children's socially appropriate behaviors (e.g., "My/This child is usually well-behaved"; "My/This child usually acts appropriately"). Parents and teachers rated the items on a 4-point scale ranging from 1 (*really false*) to 4 (*really true*). The scale demonstrated satisfactory internal reliabilities in the present sample ( $\alpha = .63$  and  $.67$  for parents' reports at W1 and W2, and  $.63$  and  $.84$  for teachers reports at W1 and W2).

**Sociability-leadership.** At W1 only, peer nominations of children's sociability-leadership were obtained using the Sociability-Leadership subscale in the Chinese version of the RCP (Masten et al., 1985; see also Chen et al., 1992). The subscale contains 14 items (e.g., "a person who is a good leader",  $\alpha = .95$ ).

### GPA (W1 and W2)

At the end of the academic years during which the W1 and W2 assessments were conducted, children's final exam scores for mathematics and Chinese were collected from school records. The

maximum raw test scores were 100, and a test score of 60 is usually considered the cut-off between a pass and a failure. Because different schools and different grades used different exams, children's raw test scores were standardized within grade and within school, and the standardized test scores were used in the analyses. Test scores were collected for 423 children at W1 and for 379 children at W2. At both waves, the standardized test scores for mathematics and Chinese were positively correlated ( $r$ s [ $N$ s = 423 and 379] =  $.27$  and  $.56$ ,  $p$ s  $< .001$  at W1 and W2, respectively). Thus, children's GPA was calculated by averaging the standardized test scores for mathematics and Chinese at each wave.

### Results

To examine the relations among child temperament, GPA, and social adjustment, first we computed zero-order correlations. Next, we conducted structural equation modeling to test the hypothesized models. First, we tested the preliminary models (see Figure 1) in which temperament effortful control and anger/frustration prospectively predict children's academic achievement, controlling for baseline academic achievement, against the data. Second, we tested two sets of autoregressive models to examine: (a) the models in which prior temperament predicts social competence or externalizing problems (controlling for baseline social competence or externalizing problems), and prior social competence or externalizing problems predict GPA (see Figures 2 and 4), and (b) the models in which prior temperament predicts GPA, and prior GPA predicts social competence or externalizing problems (see Figures 3 and 5). We tested the significance of the mediated effects using the confidence interval (CI) method (MacKinnon, Lockwood,



Hoffman, West, & Sheets, 2002). The CI method to testing mediation is selected because it provides a greater statistical power than the commonly used Baron and Kenny (1986) approach (MacKinnon et al., 2002).

### Correlations of Temperament and Adjustment to GPAs

The means and standard deviations (for the whole sample and by child gender), skewness, and kurtosis of main study variables are presented in Table 1. The zero-order correlations among all the study variables are presented in Table 2. Significant within-time correlations were found between temperament, adjustment, and GPAs. At both waves, parents' and/or teachers' reports of effortful control and social competence were positively correlated with GPA. Moreover, peer nomination of aggressive/disruptive behaviors was negatively correlated with GPA at W1. At W2, parents' and children's reports of externalizing problems and teachers' reports of anger/frustration were negatively correlated with GPA.

We also found significant cross-time correlations. Parents' and teachers' reports of effortful control and parents', teachers', and peers' reports of social competence at W1 were positively correlated with GPA at W2. Moreover, teachers' reports of anger/frustration and parents', teachers', and peers' reports of externalizing problems at W1 were negatively correlated with GPA at W2.

### Structural Equation Modeling (SEM)

Before conducting the SEM analyses, we screened the variables for normality and outliers. Five variables had high skewness (absolute value  $\geq 2$ ) and/or kurtosis ( $\geq 7$ ) using the cut-offs suggested by West,

Finch, and Curran (1995): W1 peer nomination of aggression and sociability-leadership and W2 parents' and teachers' reports of externalizing problems were positively skewed, and W2 GPA was negatively skewed. Because of the presence of nonnormal variables in the models, we conducted the SEM analyses using the MLR estimator of Mplus 4.0, which provides the standard errors and chi-square statistics for data with nonnormal outcomes (the robust statistics, see Múthen & Múthen, 1998–2006). In addition, we used Cook's distance to screen the data for outliers, and no outliers were found using the cut-off of one (Cook, 1977; Stevens, 1984). Given that the data were clustered within school classrooms (this is especially relevant for teachers' reports, as each of the 14 teachers at each wave completed the questionnaires for all the participating students in his or her class), we computed the standard errors of parameter estimates and the chi-square test of model fit using a special feature in Mplus 4.0 (Múthen & Múthen, 1998–2006), which takes into account nonindependence of observation. In this approach, parameters are estimated by maximizing a weighted log-likelihood function, and standard errors are computed using a sandwich estimator. In addition, in Mplus maximum-likelihood estimation, missing data due to attrition are allowed, but the missing values are not imputed; rather, the method uses all information that is available to estimate the model using full information maximum likelihood (Múthen & Múthen, 1998–2006).

#### The preliminary model: Predicting GPA from temperament.

The preliminary model (see Figure 1) includes two parts: the measurement model and the structural model. For constructs assessed through multiple informant reports (i.e., W1 and W2 Effortful Control), a latent factor measurement model was specified (the loading of one indicator for a given latent factor was fixed to 1 for model identification). The structural model includes the

Table 1  
Descriptive Statistics for Study Variables for the Whole Sample and by Child Gender

Variable	For the whole sample					For boys (Ns range from 156 to 186)		For girls (Ns range from 200 to 234)	
	<i>N</i>	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Effortful control W1 (P <sup>a</sup> )	402	4.65	0.65	-0.01	0.57	4.54	0.60	4.73	0.69
Effortful control W1 (T <sup>b</sup> )	419	4.89	1.07	-0.36	0.02	4.48	1.08	5.22	0.94
Anger/frustration W1 (P)	401	4.15	0.83	-0.21	0.07	4.13	0.76	4.16	0.88
Anger/frustration W1 (T)	419	3.46	0.99	0.19	-0.38	3.68	0.97	3.28	0.98
Externalizing problem W1 (P)	401	2.07	0.38	-0.02	-0.04	2.13	0.37	2.02	0.38
Externalizing problem W1 (T)	420	1.66	0.56	0.52	-0.61	1.88	0.58	1.48	0.47
Externalizing problem W1 (PE <sup>c</sup> )	382	-0.04	0.78	2.91	9.24	0.28	1.01	-0.29	0.33
Social competence W1 (P)	401	3.15	0.51	-0.67	0.58	3.07	0.52	3.22	0.51
Social competence W1 (T)	408	2.90	0.52	-0.85	0.31	2.73	0.58	3.03	0.43
Social competence W1 (PE)	382	0.05	0.79	2.37	6.39	-0.13	0.65	0.20	0.87
GPA W1	423	0.05	0.75	-1.87	5.37	-0.03	0.80	0.11	0.71
Effortful control W2 (P)	375	4.88	0.66	-0.06	-0.09	4.75	0.62	4.99	0.67
Effortful control W2 (T)	374	4.89	1.05	-0.31	-0.16	4.42	1.02	5.27	0.91
Anger/frustration W2 (P)	375	3.86	0.81	-0.13	0.10	3.85	0.79	3.87	0.83
Anger/frustration W2 (T)	374	3.71	1.04	-0.23	-0.15	3.94	1.00	3.52	1.03
Externalizing problem W2 (P)	373	0.12	0.14	2.01	5.19	0.16	0.17	0.09	0.11
Externalizing problem W2 (T)	372	0.09	0.16	3.16	11.92	0.13	0.19	0.06	0.12
Externalizing problem W2 (C)	370	0.32	0.27	1.12	1.08	0.38	0.30	0.26	0.23
Social competence W2 (P)	377	3.31	0.50	-0.67	0.14	3.19	0.53	3.40	0.45
Social competence W2 (T)	372	3.13	0.65	-0.44	-0.51	2.91	0.68	3.31	0.58
GPA W2	379	0.06	0.82	-2.34	8.83	-0.03	0.88	0.13	0.76

Note. W1 = Wave 1; W2 = Wave 2; P = parent report; T = teacher report; PE = peer report; GPA = grade point average.

autoregressive paths (i.e., paths predicting a variable or latent construct from its prior levels) and cross-time paths from effortful control and anger/frustration to GPA. Because parents' and teachers' reports of anger/frustration were unrelated to each other at W1, we tested separate models using parents' or teachers' reports of anger/frustration. Moreover, as suggested by Cole and Maxwell (2003), the measurement errors of the same measures from the same reporter (e.g., parents' reports of anger/frustration and their reports of effortful control at W1) were allowed to correlate if doing so significantly improved the overall model fit.

The preliminary models using parents' reports (see Figure 1, Model A) and teachers' reports (see Figure 1, Model B) of anger/frustration both fit with the data well,  $\chi^2s(df_s = 9 \text{ and } 11, N_s = 425) = 15.7 \text{ and } 24.8, ps = .07 \text{ and } .01$ , comparative fit indexes (CFIs) = .99 and .97, root-mean-square errors of approximation (RMSEAs) = .042 and .054. A similar pattern of results were found. In both models, parents' and teachers' reports of effortful control loaded positively on the latent factors at both waves. All the autoregressive paths were significant in positive direction, suggesting that there was cross-time consistency in effortful control, anger/frustration, and GPAs. Controlling for W1 GPA, W1 effortful control uniquely and positively predicted W2 GPA. However, W1 anger/frustration (parents' or teachers' reports) did not have unique prediction to W2 GPA.<sup>2</sup>

Results of the preliminary models suggested that W1 temperament effort control positively predicted W2 GPA, controlling for baseline GPA. We tested a series of mediation models to examine the mechanisms underlying the temperament-GPA associations. We tested two sets of alternative models: (a) the social competence/externalizing problems mediator models, in which W1 effortful control and anger/frustration predict W2 social competence or externalizing problems, and W1 competence or externalizing problems predict W2 GPA (see Figures 2 and 4); and (b) the GPA mediation models, in which W1 effortful control and anger/frustration predict W2 GPA, and W1 GPA predict W2 social competence or externalizing problems (see Figures 3 and 5). W1 social competence and W1 externalizing problems were indicated by parents' and teachers' ratings and peer nomination. W2 social competence was indicated by parents' and teachers' ratings, and W2 externalizing problems was indicated by parents', teachers', and children's reports.

**The social competence mediator models.** The models in which parents' reports (see Figure 2, Model A) or teachers' reports (see Figure 2, Model B) of anger/frustration were used both fit the data well,  $\chi^2s(df_s = 44 \text{ and } 48, N_s = 425) = 64.5 \text{ and } 97.0, ps = .02 \text{ and } .00$ , CFIs = .98 and .96, RMSEAs = .033 and .049. In both models, all the model-estimated loadings were significant in positive directions, so were the autoregressive paths, indicating cross-reporter consistency on measures of effortful control and social competence and cross-time consistency on temperament, social competence, and GPAs. As hypothesized, in both models, W1 social competence positively predicted W2 GPA, controlling for W1 GPA. In the model in which parents' reports of anger/frustration were used (see Figure 2, Model A), W1 effortful control positively predicted W2 social competence, controlling for W1 social competence. However, W1 anger/frustration (parent report) did not uniquely predict W2 social competence. In the model in which teachers' reports of anger/frustration were used (see Figure 2, Model B), W1 anger/frustration (teacher report) negatively

predicted W2 social competence. However, W1 effortful control (the latent factor) did not predict W2 social competence.

To estimate the mediational effect (temperament  $\rightarrow$  social competence  $\rightarrow$  GPA), we calculated the product of the estimated paths from W1 effortful control (parent report) or anger/frustration (teacher report) to W2 social competence and the path from W1 social competence to W2 GPA. This approach is under the assumption of stationarity (i.e., the path from W1 social competence to W2 GPA would be equal to the path from W2 social competence to W3 GPA if a third wave of data was added to the study; Cole & Maxwell, 2003). The significance of the mediational effect is tested using the CI method, which accommodates the nonnormal distribution of the product terms (MacKinnon et al., 2002; MacKinnon, Lockwood, & Williams, 2004; Meeker, Cornwell, & Aroian, 1981). If zero is not in the 90% or 95% interval of CI, then the mediational effect is significant. The results suggested that social competence marginally mediated the relation between effortful control (the latent factor) and GPA; the CI for mediational effect = .09, 1.46 ( $p = .10$ ). Social competence significantly mediated the relation between anger/frustration (teacher report) and GPA; the CI for mediational effect =  $-.54, -.01$  ( $p = .05$ ).

**The GPA mediator models for social competence.** The models in which parents' reports (see Figure 3, Model A) and teachers' reports (see Figure 3, Model B) of anger/frustration were used both fit the data well,  $\chi^2s(df_s = 46 \text{ and } 43, N_s = 425) = 71.2 \text{ and } 60.1, ps = .01 \text{ and } .04$ , CFIs = .98 and .99, RMSEAs = .036 and .031. In both models, although W1 effortful control positively predicted W2 GPA, controlling for W1 GPA, W1 GPA did not predict W2 social competence, controlling for W1 social competence.

**The externalizing problem mediator models.** The models in which parents' reports (see Figure 4, Model A) and teachers' reports (see Figure 4, Model B) of anger/frustration were used both fit the data adequately,  $\chi^2s(df_s = 60 \text{ and } 59, N_s = 425) = 115.9 \text{ and } 134.4, ps < .001$ , CFIs = .95 and .93, RMSEAs = .047 and .055. In the model in which parents' reports of anger/frustration was used (see Figure 4, Model A), W1 anger/frustration (parent report) positively predicted W2 externalizing problems, controlling for W1 externalizing problem, and W1 externalizing problems predicted W2 GPA, controlling for W1 GPA. However, W1 effortful control did not uniquely predict W2 externalizing problems. In the model in which teachers' reports of anger/frustration was used (see Figure 4, Model B), neither W1 effortful control nor anger/frustration (teacher report) uniquely predicted W2 externalizing problems, although W1 externalizing problems negatively predicted W2 GPA.

On the basis of the model in which parents' reports of anger/frustration was used (see Figure 4, Model A), mediational analyses suggested that externalizing problems significantly mediated the

<sup>2</sup> Because some researchers suggested that negative emotionality (including anger/frustration) might interact with effortful control in relating to child development outcomes (e.g., Eisenberg et al., 1996; Oldehinkel et al., 2007), we also tested the interaction between effortful control and anger/frustration in predicting children's GPA. In a set of ordinary least squares regressions, we predicted W2 GPA from W1 effortful control (the composite of parents' and teachers' report), W1 anger/frustration (parents' or teachers' report), the Effortful Control  $\times$  Anger/Frustration interaction, and W1 GPA. None of the interaction effects was significant, suggesting that anger/frustration did not moderate the relation between effortful control and GPA.

Table 2  
Zero-Order Correlations Among Variables

Variable	1	2	3	4	5	6	7	8	9	10
1. EC-1 (P)	—									
2. EC-1 (T)	.35***	—								
3. ANG-1 (P)	-.29***	-.07***	—							
4. ANG-1 (T)	-.17***	-.60***	.08	—						
5. EXT-1 (P)	-.43***	-.30***	.40***	.21***	—					
6. EXT-1 (T)	-.20***	-.58***	.02	.59***	.22***	—				
7. EXT-1 (PE)	-.10*	-.46***	-.03	.26***	.11*	.43***	—			
8. SOC-1 (P)	.26***	.38***	-.05	-.15**	-.06	-.13*	.01	—		
9. SOC-1 (T)	.45***	.24***	-.22***	-.13*	-.42***	-.23***	-.18**	.24***	—	
10. SOC-1 (GPA)	.22***	.64***	-.04	-.30***	-.15**	-.39***	-.42***	.32***	.25***	—
11. GPA-1	.15**	.37***	-.05	-.09	-.10	-.05	-.15**	.29***	.10	.40***
12. EC-2 (P)	.47***	.43***	-.17**	-.26***	-.29***	-.34***	-.25***	.25***	.36***	.33***
13. EC-2 (T)	.23***	.63***	-.05	-.50***	-.19***	-.40***	-.46***	.35***	.14*	.44***
14. ANG-2 (P)	-.22***	-.15**	.42***	.14**	.22***	.13*	.06	-.15**	-.20***	-.10
15. ANG-2 (T)	-.23***	-.43***	.10	.38***	.20***	.31***	.29***	-.25***	-.14**	-.24***
16. EXT-2 (P)	-.23***	-.39***	.17**	.27***	.29***	.32***	.26***	-.21**	-.26***	-.30***
17. EXT-2 (T)	-.10	-.39***	.02	.38***	.14**	.34***	.42***	-.11*	-.05	-.33***
18. EXT-2 (C)	-.16**	-.27***	.13*	.17**	.21***	.21***	.25***	-.18**	-.18**	-.26***
19. SOC-2 (P)	.31***	.39***	-.13*	-.24***	-.29***	-.29***	-.30***	.31***	.45***	.37***
20. SOC-2 (T)	.23***	.55***	-.10	-.43***	-.21***	-.31***	-.33***	.32***	.19***	.43***
21. GPA-2	.26***	.38***	-.08	-.14**	-.12*	-.11*	-.15**	.25***	.22***	.29***

Note. EC = effortful control; P = parent report; T = teacher report; ANG = anger/frustration; EXT = externalizing problems; PE = peer report; SOC = social competence; C = child report; GPA = grade point average.

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

relation between anger/frustration (parent report) and GPA; CI for mediational effect =  $-.06, -.002$  ( $p = .05$ ).

**The GPA mediator models for externalizing problems.** The models in which parents' reports (see Figure 5, Model A) and teachers' reports (see Figure 5, Model B) were used both fit the data well,  $\chi^2$ s( $dfs = 62$  and  $59$ ,  $Ns = 425$ ) =  $111.1$  and  $115.5$ ,  $ps < .001$ , CFIs =  $.96$  and  $.94$ , RMSEAs =  $.043$  and  $.047$ . In both models, W1 effortful control (the latent factor) positively predicted W2 GPA, controlling for W1 GPA, and W1 GPA negatively predicted W2 externalizing problems, controlling for W1 externalizing problems. Mediational analyses suggested that GPA significantly mediated the relation between effortful control and externalizing problems; CIs for mediational effects =  $-.03, -.003$  and  $-.04, -.004$  for the models in which parents' reports (see Figure 5, Model A) and teachers' reports (see Figure 5, Model B) of anger/frustration, respectively, were used ( $ps = .05$ ).

In summary, the SEM analyses suggested that W1 effortful control positively predicted and W1 anger/frustration (teacher report) negatively predicted W2 social competence, and W1 social competence positively predicted W2 GPA (see Figure 2, Models A and B). Mediational analyses indicated that social competence at least marginally mediated the relations between temperament and GPA. However, the hypothesis that academic achievement mediates the temperament–social competence association was not supported. Although W1 effortful control predicted W2 GPA, W1 GPA did not predict W2 social competence (see Figure 3, Models A and B). In contrast, both the hypothesis that externalizing problems mediates the temperament–achievement association and the hypothesis that academic achievement mediates the temperament–externalizing problems association were partially supported. Specifically, W1 anger/frustration (although only with parent report) positively predicted W2 externalizing problems, and

W1 externalizing problems negatively predicted W2 GPA (see Figure 4, Model A). Moreover, W1 effortful control positively predicted W2 GPA, and W1 GPA negatively predicted W2 externalizing problems (see Figure 5, Models A and B).

## Discussion

To our knowledge, this is the first longitudinal study in which the relations of temperament effortful control and anger/frustration to Chinese children's academic achievement have been examined. An important strength of the present study is the multimethod and multi-reporter approach to assessment. Because temperament and academic achievement were assessed using different methods, it is unlikely that the association found between temperament and achievement was due to common method effect. Another strength of the study is the investigation of the potential mechanisms underlying the temperament–achievement association. With two waves of panel data, we tested the potential roles of social competence and externalizing problems as mediators in the temperament–achievement relations as well as the bidirectional relations between academic achievement and two aspects of school adjustment (social competence and externalizing problems). The results provided interesting insight about the dynamic relations among temperament, academic achievement, and sociobehavioral adjustment in Chinese school-age children.

### The Relations of Temperamental Effortful Control and Anger/Frustration to Chinese Children's Academic Achievement

As shown by the cross-time correlations and autoregressive paths predicting W2 temperament from its W1 correspondent,

Table 2 (Continued)

11	12	13	14	15	16	17	18	19	20	21
—										
.23***	—									
.35***	.38***	—								
-.08	-.43***	-.15**	—							
-.16**	-.27***	-.69***	.12*	—						
-.18**	-.52***	-.42***	.35***	.27***	—					
-.14**	-.26***	-.53***	.15**	.47***	.29***	—				
-.16**	-.36***	-.31***	.26***	.20***	.46***	.17**	—			
.18***	.57***	.32***	-.25***	-.17***	-.48***	-.21***	-.34***	—		
.37***	.30***	.71***	-.15**	-.55***	-.31***	-.53***	-.21***	.31***	—	
	.21***	.34***	-.10	-.20***	-.18***	-.08	-.10*	.22***	.41***	—

Chinese children's effortful control and anger/frustration demonstrated moderate to high levels of rank-order stability across the 3.8-year period, showing traitlike characteristics. Consistent with our hypotheses, effortful control measured by parents' and teachers' reports in first and second grade positively predicted Chinese children's GPA in fifth and sixth grade. This result was found after controlling for baseline GPA, which provided a more robust test of the directional relation between effortful control and academic achievement than cross-sectional studies or longitudinal studies in which prior level of achievement was not controlled. Therefore, the *direction* of the associations between effortful control (e.g., attention or emotion regulation, inhibitory control) and academic achievement in Chinese children is similar to those found with Western samples (e.g., Blair & Razza, 2007; Eisenberg et al., 2005; Valiente et al., 2008). With regard to the strength of associations, the cross-time correlations between effortful control and GPA found in the present study (.26 and .38) were generally similar to those found in previous studies with Western samples (e.g., .17 and .38 in Blair & Razza, 2007; .14 and .20 in Liew, McTigue, Barrois, & Hughes, 2008). One exception to this pattern was the study by Valiente et al., (2008) in which the authors found slightly higher cross-time correlations (.48 and .52) between effortful control and GPA. The time interval in between assessments (one semester) in Valiente et al. (2008) was much shorter than that in the present study (3.8 years), which might partly explain the differences in the strength of correlations. However, it is important to note that future cross-cultural studies need to be conducted to compare the strength of associations across cultures directly.

Moreover, our results extended previous work on the roles of effortful control in Chinese children's behavioral and social development (e.g., externalizing and internalizing problems and social competence; Eisenberg et al., 2007; Zhou et al., 2004, 2008) by demonstrating the link of effortful control to Chinese children's

academic development. Thus, similar to the findings in Western culture, effortful control—which reflects temperament-based individual differences in attention, emotion, and self-regulation (Rothbart & Bates, 2006)—appears to be a general predictor of children's psychological well-being and multiple domains of competence in the Chinese society. The cross-cultural similarities in the empirical relations between effortful control and child adjustment outcomes support that there are cross-cultural similarities in the societal values/attitudes toward effortful control.

In contrast, anger/frustration did not uniquely predict Chinese children's GPA, controlling for effortful control and baseline GPA (see Figure 1). However, in correlation analyses, some concurrent and cross-time negative correlations were found between teachers' (but not parents') reports of anger/frustration and children's GPA. Considering the lack of agreement between parents' and teachers' ratings of Chinese children's anger/frustration (which might suggest that Chinese children express anger differently at home vs. at school due to the greater emphasis on inhibition of anger in a classroom setting; see Zhou et al., 2004), the present findings suggest that perhaps it is Chinese children's display of anger/frustration in the school context rather than at home that is detrimental to their academic development. However, it is important to note that parents' ratings of anger/frustration had lower (albeit acceptable) alpha reliabilities than teachers' ratings, which might partly explain the lack of correlation between parent reports of anger/frustration and GPA. As a result of the one-child-per-family policy in China, Chinese parents rarely have the opportunity to interact with multiple children with different temperament characteristics. In contrast, with their rich experience in working with a large number of children in a classroom, it is not surprising that the Chinese teachers provide more consistent and reliable ratings of children's temperament than Chinese parents.



The anger/frustration–GPA associations in the present sample were generally weaker and less consistent (across reporters) than the effortful control–GPA associations, suggesting that effortful control might be a stronger predictor of Chinese children’s academic achievement than anger/frustration. This finding is somewhat consistent with the limited literature on anger and academic performance with Western samples (e.g., Boekaerts, 1993; Supplee et al., 2004). Although anger/frustration did not interact with effortful control in predicting academic achievement in our sample (see Footnote 2), other researchers suggested that the anger–achievement association might be moderated by emotion regulation (e.g., Heaven et al., 1989). Moreover, the finding that W1 anger/frustration (at least the teachers’ reports) was correlated with W2 GPA, but it did not uniquely predict W2 GPA after controlling for baseline GPA, and W1 effortful control in the SEM analyses indicates either (a) that the effect of anger/frustration on GPA might overlap with the effect of effortful control or (b) that the relation between anger/frustration and GPA is established at baseline (first and second grades), and anger does not predict *change* in GPA during elementary school years.

### Social Competence and Externalizing Problems as Potential Mediators in the Temperament–Academic Achievement Associates

Multiple mechanisms are likely involved in the temperament–academic achievement associations (Eisenberg et al., 2005), including the cognitive mechanisms (e.g., Blair, 2002; Blair & Razza, 2007), motivational mechanisms (e.g., Meece, Anderman, & Anderman, 2006; Rothbart & Jones, 1998; Zimmerman, 1998), and interpersonal mechanisms (e.g., Dougherty, 2006; Valiente et al., 2008). In the present study, we tested social competence and externalizing problems as potential mediators in the temperament–achievement association, which shed some light on these mechanisms.

**Social competence.** As shown in Figure 2, Model A, the children who displayed high effortful control at W1 (early elementary school) developed higher social competence 4 years later than those with low effortful control, and the children with high social competence at W1 had higher GPAs 4 years later than those with low social competence. Moreover, although anger/frustration (teacher report) did not have a direct relation to children’s GPA (see Figure 1, Models B), it negatively predicted children’s social competence (see Figure 2, Model B). Mediation analyses based on two waves of panel data supported the hypothesis that social competence at least marginally mediated the relations between temperament and academic achievement. These results supported the interpersonal mechanism that children with high effortful control or low anger/frustration develop higher social competence and receive greater acceptance by teachers and peers, which in turn constitutes the emotional and social resources for achievement in school (e.g., Wentzel, 1991; Wentzel & Asher, 1995). Perhaps socially competent children are more likely to request and receive help from teachers and peers on academic tasks. Moreover, socially competent children who develop better relationships with peers like school better and are more motivated to engage in classroom learning (Buhs, Ladd, & Herald, 2006), which is consistent with the motivational mechanism.

Although researchers have suggested that the relation between social competence and academic achievement is reciprocal (Chen et al., 1997; Welsh et al., 2001), we did not find support for the reciprocal effect of social competence on children’s GPA. Specifically, W1 GPA did not predict W2 social competence, controlling for W1 social competence (see Figure 3, Models A and B), and thus, the hypothesis that GPA mediates the temperament–social competence relation was not supported. The discrepancy between our results and the results of Chen et al. (1997) might be due to the longer time interval between assessments in the present study (3.8 years) and that (2 years) in Chen et al. (1997). Thus, because of the greater fluctuation in children’s academic achievement across time (as indicated by the smaller rank-order stability coefficient for GPA compared with other constructs), the influence of academic achievement on children’s social competence might be relatively short term. Moreover, the lack of cross-lagged paths from academic achievement to social competence might be due to the possibility that peer group academic performance moderated the achievement–social competence association. Chen et al. (2008) found that academic achievement predicted higher social competence over time for the Chinese children in high-achieving (but not in low-achieving) peer groups. Thus, children with high academic achievement in low-achieving peer groups may not receive social acceptance and support from peers and show improvement in social competence because academic achievement is not valued in the group (Chen et al., 2008).

**Externalizing problems.** We found that W1 temperament anger/frustration (parent report) positively predicted W2 externalizing problems, and W1 externalizing problems negatively predicted W2 academic achievement (see Figure 4, Model A). Thus, although anger/frustration did not uniquely predict academic achievement in the preliminary model, the relation between anger/frustration and academic achievement was indirect through externalizing problems. MacKinnon, Fairchild, and Fritz (2007) suggested that mediation might exist despite of an insignificant overall relation between the predictor and the outcome. The significant mediational effect (anger/frustration → social competence → GPA) is consistent with the temperament research on the links between anger/frustration and externalizing problems (e.g., Calkins & Dedmon, 2000; Eisenberg et al., 2001, 2007, 2005; Kochanska & Knaack, 2003; Olson et al., 2005) and the research on the links between externalizing problems and academic achievement (e.g., Bub, McCartney, & Willett, 2007; Stipek & Miles, 2008). Hoglund (2007) suggested that children with externalizing problems tend to disengage from school in various means. For example, they might withdraw from participation in learning activities (behavioral disengagement); lose interest and enjoyment in academic tasks (emotional disengagement); and have reduced mental effort, cognitive flexibility, and motivation directed toward learning (cognitive disengagement). School disengagement, in turn, undermines their academic achievement. Moreover, children with externalizing problems are likely to experience peer rejection and victimization or teacher–child conflict, which in turn leads to school disengagement and low academic achievement (Hoglund, 2007; Stipek & Miles, 2008). Thus, the present finding supports the cognitive, motivational, and interpersonal pathways from temperament to academic achievement.

Although the models in which parents’ versus teachers’ reports of anger/frustration were used generally yielded a consistent pat-

tern of results, there were some slight differences. Specifically, teachers' reports of anger/frustration uniquely predicted children's social competence, controlling for effortful control (see Figure 2, Model A), whereas parents' reports of anger/frustration did not (see Figure 2, Model B). In contrast, parents' reports of anger/frustration uniquely predicted externalizing problems, controlling for effortful control (see Figure 4, Model A), whereas teachers' reports of anger/frustration did not (see Figure 4, Model B). These differences might reflect the fact that parents and teachers observe somewhat different aspects of children's temperament anger/frustration, which has different implications for different types of adjustment outcomes. Perhaps the display of anger/frustration in a school setting is more detrimental to children's social competence, whereas the display of anger/frustration at home does more harm to children's behavioral adjustment. However, because parents' and teachers' ratings of children's temperament might also reflect their expectation and perception of children's temperament, future research using other assessment methods (e.g., behavioral, observational, and physiological measures) should be conducted to test the above interpretation.

The hypothesis regarding the reciprocal relation between externalizing problems and academic achievement was also supported. Children with low academic achievement displayed greater externalizing problems over time. It is possible that academic failure evokes the feelings of anger and frustration, which often motivates aggressive and disruptive behaviors (Berkowitz, 1993). Moreover, children with academic failure may become associated with deviant peers whose norm promotes externalizing behaviors (Sher, 1991). In addition, because of high societal and familial values that encourage academic achievement in the Chinese culture (Phelps, 2005; Salili & Lai, 2003), the Chinese children with low academic achievement might be particularly vulnerable to social rejection, such as being disliked by peers and teachers and receiving criticism from families, which puts them at a high risk for externalizing problems.

**Implications for intervention.** The present findings reveal the complex and dynamic interplays among child temperament, academic achievement, social competence, and externalizing problems. Specifically, children with low effortful control or high anger/frustration are susceptible to low academic achievement likely because of the temperament-related risks for social incompetence and externalizing problems. Moreover, children with poor academic achievement might be susceptible to further escalation in externalizing problems. The findings have two implications for prevention and treatment of academic and behavioral problems among school-age children. First, children displaying temperament precursors (e.g., low effortful control) to academic problems may be identified as early as beginning school age. These children can benefit from interventions that target the cognitive, interpersonal, and motivational processes associated with low effortful control and school failure. Second, the interventions for children experiencing or at risk for academic failure must take into account the interplay between academic achievement and sociobehavioral adjustment and include intervention efforts that target multiple domains of school functioning.

### Limitations and Conclusions

The study has several limitations. First, children's academic achievement was measured by GPA. Due to variation in test contents and difficulties across grades and schools, standardized

tests of academic achievement can provide a more accurate assessment of children's academic skills. Moreover, although GPA reflects the child's overall academic achievement, measures of individual academic skills (e.g., vocabulary, reading fluency, math fluency) can allow researchers to examine the specific relations of temperament dimensions to various domains of academic skills. Second, as mentioned earlier, with only two waves of panel data, the full mediation pathway (e.g., temperament → social competence or externalizing problems → GPA) cannot be tested directly. However, we tested the significance of the mediated effects by assuming that the relations between W1 mediators and W2 outcomes are equivalent to the relations between W2 mediators and W3 outcomes if a third wave of data was added to the study (Cole & Maxwell, 2003). Although we are not aware of any strong empirical evidence suggesting that the relations between children's social and behavioral adjustment and academic achievement change substantially during the elementary school period, it is important to note that there are likely limitations to the stationarity assumption underlying our tests of mediation. Future studies that include at least three waves of assessments on temperament, academic achievement, and sociobehavioral adjustment can provide a more stringent test of the mediation hypotheses. Third, we did not assess children's intelligence, which might confound the relation between effortful control and GPA. However, effortful control (measured by teachers' reports and behavioral tests) and intelligence made unique and independent predictions of children's mathematics abilities in a recent study of Western children (Blair & Razza, 2007), suggesting that the temperament–academic achievement associations cannot be fully explained by intelligence. In addition, even though the Chinese participants did not report much difficulty in responding to the translated items in our pilot study, a few negatively worded items in the temperament measures showed a low convergence with the rest of the scale and were dropped from the analyses. Although eliminating these items did not alter the study results (see Footnote 2), in future cross-cultural research, it is important to further understand the sources of participants' difficulties in responding to translated instruments.

In summary, low temperament effortful control in early elementary school predicted Chinese children's low academic achievement in late elementary school. Analyses of the potential mechanisms underlying the temperament–achievement associations were consistent with the hypotheses that social competence and externalizing problems mediated the relations between temperament and academic achievement. Moreover, the relations between externalizing problems and academic achievement were reciprocal such that children with low academic achievement displayed greater externalizing problems over time.

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