

## Effortful control and early academic achievement of Chinese American children in immigrant families<sup>☆</sup>

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### ABSTRACT

The present study examined the direct and indirect relations of family contextual factors, effortful control (EC), and the early math and English literacy skills of first and second-generation Chinese American immigrant children in early elementary school. Using a socioeconomically diverse sample of 258 Chinese American children (53% receiving free- or reduced-price school lunch), we assessed EC with a combination of parent and teacher reports, computerized neuropsychological tests, and a behavioral frustration task. Children's math calculation and English literacy skills were assessed with standardized achievement tests. Results of structural equation modeling suggested that: (a) EC was positively associated with both math and English literacy skills; (b) parents' enculturation was marginally and positively associated with children's EC, and EC mediated the link between parent's enculturation and children's achievement; (c) authoritarian parenting was marginally and negatively associated with children's EC, and EC mediated the link between authoritarian parenting and children's achievement; (d) parents' enculturation had a direct and negative link to children's English literacy skills; and (e) no evidence of an EC × SES interaction was found. The findings highlight the need to consider joint influences of socioeconomic, interpersonal, and cultural factors on children's academic development in immigrant families; and provide support for promoting children's effortful control as an intermediate target of intervention.

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### Introduction

A growing body of literature indicates that self-regulation skills play a critical role in children's school readiness and early academic development (Eisenberg, Valiente, & Eggum, 2010; Ursache, Blair, & Raver, 2012). In particular, effortful control (EC), a self-regulation construct originating from temperament-based

frameworks (Rothbart & Bates, 2006), has been consistently associated with children's higher early academic skills (Eisenberg et al., 2010; Liew, 2012). Though this line of research has been expanded to include children from non-Western cultures (Zhou, Main, & Wang, 2010), low-income families (Blair & Razza, 2007; Morris et al., 2013), and ethnic-minority families (Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008), little is known regarding the role of EC in the early academic achievement among children of immigrants. Further, few researchers have examined associations between family factors – e.g., socioeconomic status (SES), parent acculturation and enculturation, and parenting styles – and EC in young children of immigrants. This line of research can provide theoretical foundations for promoting EC and academic competence in children of immigrant families via culturally competent interventions.

Asian American immigrant families represent the largest group of new immigrants to the United States (Pew Research Center, 2012). In parallel to the wide-spread public stereotype of Asian Americans as a uniformly high-achieving “model minority” (Tran & Birman, 2010), much existing research on academic development of Asian American children has focused on comparing Asian American children with other ethnic or cultural groups (Han, 2008; Han, Lee, & Waldfogel, 2012; Koury & Votruba-Drzal, 2014). By contrast, few

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researchers have investigated how family factors (e.g., SES, parenting styles, and parent acculturation) are associated with variations in EC and academic achievement among Asian American children.

#### *Effortful control and children's early academic achievement*

EC is broadly defined as the voluntary inhibition of a prepotent, dominant response in order to activate a subdominant response (Blair & Razza, 2007; Rothbart & Bates, 2006). As a multi-dimensional construct, EC is theorized to involve multiple interrelated components including inhibitory control, attention focusing and shifting, as well as conflict resolution or cognitive flexibility (Kochanska, Murray, & Harlan, 2000; Rothbart, Ahadi, & Evans, 2000). Although early work on EC was primarily based on a temperament perspective, recent theory and research on self-regulation skills suggests that there is much overlap in both the components and measures of EC and executive function, a self-regulation construct emerging from cognitive and neuroscience frameworks (Bridgett, Oddi, Laake, Murdock, & Bachmann, 2013; Zhou, Chen, & Main, 2012). Thus, researchers have increasingly begun to incorporate neuropsychological measures of attention, inhibition, and cognitive flexibility into assessments of EC or executive function (Bridgett et al., 2013; Neuenschwander, Röthlisberger, Cimeli, & Roebbers, 2012; Willoughby, Blair, Wirth, & Greenberg, 2012). Moreover, factor analyses of EC measures yield support for a single-factor structure in preschool and early school-age children (Allan & Lonigan, 2011; Sulik et al., 2010).

EC and other self-regulatory skills are viewed as critical components of children's school readiness and determinants of their early academic achievement (Eisenberg et al., 2010; Liew, 2012). Multiple processes are thought to be involved in the role of EC in children's academic development. For example, children with higher EC can be expected to be better at sustaining their attention in doing schoolwork, better at regulating their emotion and emotion-related impulses in peer and classroom interactions, and more motivated, engaged, and persistent in their learning (Chang & Burns, 2005; Eisenberg, Smith, Sadovsky, & Spinrad, 2004; Liew, 2012; Valiente et al., 2011). Indeed, various measures of EC (including adult report and lab-based measures) predicted early academic achievement of school-age children, and these relations were partly mediated by children's socio-emotional adjustment and learning-related behaviors (Morris et al., 2013; Neuenschwander et al., 2012; Valiente et al., 2011; Zhou et al., 2010).

#### *The role of effortful control in the links between family factors and immigrant children's achievement*

Based on the bioecological model of human development (Bronfenbrenner & Morris, 2006), academic development in children of immigrant parents can be jointly influenced by a host of person, process, and contextual characteristics. Previous research has shown that several family factors are associated with early achievement of children in immigrant families: (a) socioeconomic status (SES) (Han, 2008; Han et al., 2012), (b) parent acculturation, especially in the domain of English proficiency (Han et al., 2012), and (c) parenting practices (Koury & Votruba-Drzal, 2014). Applied to the bioecological framework, these family factors reflect both proximal processes (e.g., parent-child relationship and parenting) and aspects of the exosystems (e.g., SES, family's ethnic and cultural backgrounds) that can shape children's academic development.

The bioecological theory also emphasizes person characteristics as shapers of the child's own development. Specifically, "developmentally generative characteristics" such as "curiosity, tendency to initiate and engage in activity alone or with others, responsiveness to initiatives by others, and readiness to defer immediate gratification to pursue long-term goals" are thought

to "set proximal processes in motion and sustain their operation" (Bronfenbrenner & Morris, 2006, p. 810). Based on this view, there are at least two processes through which children's EC shapes their academic development. First, EC might mediate the impact of contextual factors (e.g., family SES or cultural orientations) or proximal processes (e.g., parenting) on children's academic achievement. Second, EC might interact with contextual factors or proximal processes in shaping children's academic development. Because previous applications of the bioecological theory have rarely integrated assessment of EC (with the exception of the work by Li-Grining, 2007, 2012), these hypotheses have not been explicitly tested in the literature. Below we provide a brief review of the literature on the specific family factors examined in the present study and their links to EC and achievement.

**SES.** A robust body of literature indicates that children from families lower in socioeconomic status (SES) have poorer academic outcomes and poorer self-regulatory capacities (Bradley & Corwyn, 2002; Hackman & Farah, 2009). In an ethnically diverse community sample representing a full range of income, Thompson, Lengua, Zalewski, and Moran (2013) found that disruptions in preschoolers' EC mediated the link between low income and children's adjustment and social problems. These associations between SES, EC, and academic achievement are particularly relevant to Chinese Americans, a population that is striking in its socioeconomic diversity. Chinese American adults exceed national averages in obtaining bachelors' degrees (51.1% vs. 28.2%), but also exceed national averages in failures to complete high school (18.0% vs. 14.4%). Similarly, though Chinese Americans report household annual incomes that are higher than the national median (\$65,060 vs. \$49,800), a higher percentage of Chinese Americans also fall below poverty lines (13.7% vs. 12.8%) (Pew Research Center, 2012). The within-group variation in Chinese American families' SES makes this group an ideal sample in which to study the relations of SES to children's EC. Consistent with the findings of Thompson et al. (2013), we hypothesized that low-SES (low income and low parental education) would be associated with Chinese American children's lower EC, which mediates the link between low-SES and low achievement.

Because EC is a biologically-based temperament trait shaped by environmental and genetic factors (Rothbart, Sheese, & Posner, 2007), it is also possible that EC serves as a protective factor moderating the link between adverse environmental factors (e.g., low SES) and immigrant children's adjustment (Zhou, Tao, et al., 2012). A potential process underlying this protective effect is that better self-regulatory skills enable children to cope more effectively with chronic stressors. For example, Evans and Fuller-Rowell (2013) found that children's self-regulation moderated the relation between childhood poverty and adult working memory: those with higher self-regulatory skills were less affected by the harmful effects of poverty on working memory. Based on this finding, we hypothesized that EC would interact with SES in relation to achievement such that low SES would be less strongly associated with low academic achievement for children with higher EC than those with lower EC.

**Parenting styles.** In a bioecological framework, parenting styles and practices may be conceptualized as a child's proximal processes – regular interactions with persons in his/her immediate environment (Bronfenbrenner & Morris, 2006). There is an extensive literature supporting the role of parenting practices in children's development of EC. Specifically, warm and supportive parenting is thought to promote EC by maintaining optimal levels of arousal and creating a positive environment for children to learn constructive ways of regulating their emotions, attention, and behaviors (Eisenberg, Cumberland, & Spinrad, 1998). Moreover, parental use of positive disciplinary strategies such as reasoning, encouraging child autonomy, and scaffolding are hypothesized to promote EC by facilitating children's internalization of parental rules and

expectations and the transition from externally regulated to self-regulated behaviors (Bernier, Carlson, & Whipple, 2010; Kopp, 1982). Consistent with these theories, researchers have found positive relations between children's EC and supportive or authoritative parenting (i.e., the parenting style characterized by high warmth, use of reasoning, and encouragement of autonomy; Baumrind, 1994), and negative relations between children's EC and negative or authoritarian parenting (i.e., the parenting style characterized by low warmth and high use of coercion and punishment; Baumrind, 1994) (Eisenberg et al., 2005; Lengua, Honorado, & Bush, 2007; Spinrad et al., 2012; Zhou, Eisenberg, Wang, & Reiser, 2004). Importantly, these relations have been found in children of native Chinese families (Zhou et al., 2004, 2008), suggesting cross-cultural generalizability in the roles of authoritative and authoritarian parenting in children's EC development. Also relevant to the present study, previous research by Li-Grining (2007) indicated that parent-child connectedness was positively associated with measures of EC in low-income, ethnic minority preschoolers. Based on these findings, we hypothesized that authoritative parenting would be positively associated with, and authoritarian parenting would be negatively associated with Chinese American children's EC. We also expected that EC would mediate the links between parenting styles and children's academic achievement.

*Parent acculturation and enculturation.* Although authoritative and authoritarian parenting styles reflect core dimensions of parenting that are common across cultures (Sorkhabi, 2005), some researchers have argued that they may not capture the culturally-specific parenting practices or beliefs in Chinese families (Chao, 1994). For example, Chinese parenting practices are thought to be influenced by Confucian principles, such as the emphasis on self-restraint (e.g., self-control of behaviors and emotions) and the pursuit of knowledge (e.g., diligence and persistence in learning) (Luo, Tamis-LeMonda, & Song, 2013). In support of these theories, a number of cross-cultural investigations have indicated that, compared to parents of Western/European American backgrounds, Chinese and Chinese American immigrant parents place greater emphasis on children's behavioral control, discipline, and academic achievement (Chao, 1994, 2000; Huntsinger, Jose, Larson, Balsink-Krieg, & Shaligram, 2000; Jose, Huntsinger, Huntsinger, & Liaw, 2000; Pearson & Rao, 2003). Further, several cross-cultural studies have reported that young children from East Asian countries (e.g., China and Korea) outperformed North American children on executive functioning tasks assessing inhibitory and attentional control (Lan, Legare, Ponitz, Li, & Morrison, 2011; Oh & Lewis, 2008; Sabbagh, Xu, Carlson, Moses, & Lee, 2006). These cultural differences have been attributed to East Asian cultures' greater emphasis on children's inhibitory and attentional control at home and in school settings. For example, consistent with the cultural emphasis on diligence and persistence in learning, Chinese parents are more likely to engage children in formal and work-oriented learning activities than European American parents (Luo et al., 2013). However, because socialization practices were not measured in cross-cultural studies on children's EC or executive functioning, researchers could not explicitly test whether cultural differences in socialization practices can explain the cultural differences in children's executive functioning or EC.

Immigrant families provide an excellent sample in which to study cultural influences on the socialization of EC because immigrants can simultaneously adopt the values, practices, and behaviors of the host and heritage cultures (Gonzales, Fabrett, & Knight, 2009). Moreover, within a bioecological framework, an immigrant parent's engagement with these cultures can represent both exosystem influences (e.g., parents' interactions with their Chinese or European American friends) as well as microsystem influences (e.g., parents providing an English or Chinese language home environment) on children's development. Thus, by assessing

parents' levels of acculturation (i.e., adaptation to the mainstream or host culture) and enculturation (i.e., adaptation to, or maintenance of immigrants' heritage culture), researchers can examine the joint and unique relations of parents' cultural orientations and children's developmental outcomes.

In previous studies, Chinese American immigrant parents' cultural orientations have been associated with their emotion-related parenting behaviors such as emotion discussion with children (Tao, Zhou, Lau, & Liu, 2013) and expression of emotion (Chen, Zhou, Main, & Lee, 2014). Given the established links between emotion-related parenting behaviors and children's EC (Eisenberg et al., 1998), it is possible that parents' cultural orientations are also associated with children's EC, and that EC might mediate the links between parents' cultural orientations and children's achievement. Researchers have previously found a direct positive association between immigrant parents' English proficiency (a specific domain of acculturation) and children's early academic skills (Han et al., 2012). Because cultural orientations encompass multiple domains of cultural contact and engagement (Gonzales et al., 2009), multiple processes may be involved in how parents' cultural orientations shape children's academic outcomes, including both direct and indirect links.

Based on the cross-cultural research on children's EC and the research on the links between parents' cultural orientations and parenting behaviors in immigrant families, we hypothesized that Chinese American parents' enculturation (i.e., Chinese orientation) would be positively associated with children's EC controlling for parents' levels of acculturation (i.e., American orientation). Accordingly, we expected that children's EC would mediate the links between parents' enculturation and children's achievement.

### *The present study*

In summary, Chinese American immigrant families provide a unique population in which to examine how process, person, and contextual components of the bioecological model relate to children's academic achievement. Indeed, while previous theoretical models have identified similar factors as being critical to the development of self-regulation in ethnic minority immigrant children (Li-Grining, 2012), to our knowledge, these constructs have yet to be integrated within a single investigation. Thus, the goals of the present study were to test: (a) the relations between EC and children's academic achievement, (b) the relations of family factors to Chinese American children's EC, and whether EC mediates the relation between family factors and children's achievement; and (c) EC as a moderator in the relation between family SES and children's achievement. The study was conducted with a socio-economically diverse sample of Chinese American children ( $N=258$ , in first- or second-grade) in immigrant families (i.e., the children were either first- or second-generation immigrants), with more than 50% of the participating children coming from low-income families. To reduce common method variance, children's EC was assessed using a multi-method and multi-informant battery, and academic achievement was assessed using standardized tests.

## **Method**

### *Participants*

The sample included 258 first-generation (born outside the United States, 23.6% of the sample) and second-generation (born in the U.S., 76.4% of the sample) Chinese American children, their parents, and teachers. Participants were part of a larger longitudinal study on Chinese American children's psychological adjustment and academic development. Data for the present study were

collected in the first wave of assessment. The children and families were recruited from local schools and communities in a northwestern metropolitan area in the United States. Because one aim of the larger study was to examine the relation of family socioeconomic status to children's developmental outcomes, we aimed to sample children from both low-income and middle-income families (see recruitment procedures below).

The children (48.1% were girls) were in first (48.8%) or second grade (age range = 5.8–9.1 years,  $M = 7.4$  years,  $SD = 0.71$ ). The majority (92.5%) of children were from two-parent families, whereas 7.5% were from single-parent (including never married, divorced, or widowed) families. All parents identified as either Chinese or Chinese American. Almost all parents (98.8% of mothers and 95.7% of fathers) were foreign born: 77.3% of mothers and 68.8% of fathers were born in mainland China, 9.0% and 8.6% were born in Hong Kong, 2.7% and 3.1% were born in Taiwan, and 9.5% and 15.2% were born in other parts of the world. On average, parents had lived in the U.S. for more than one decade (range = 0.5–50 years,  $M_s = 11.1$  and 15.1 years and  $SD_s = 6.8$  and 9.7 for mothers and fathers). Parent years of school education ranged from 0 to 20 years (Doctorate or other advanced degree), and the mean years of education were 13.0 ( $SD = 2.5$ ) and 13.2 ( $SD = 3.0$ ) years (some college education) for mothers and fathers, respectively. Fifty-seven percent of mothers and 76.7% of fathers were employed full-time, 17% and 7.7% were employed part-time, and 12.9% and 6.8% were unemployed or homemakers. Families' household *per capita* income was calculated by dividing the total family income for the past year by the number of individuals living in the household (Datta & Meerman, 1980). Consistent with the goal of sampling children from both low-income and middle-income families, families' annual *per capita* income in the sample ranged from \$625 to \$50,000 ( $M = \$11,607$ ,  $SD = \$8309$ ), and 57.3% of children were receiving free or reduced-price lunch at school.

#### Procedures

**Recruitment.** The sample was recruited using a variety of methods, including recruitment through schools, referrals from Asian American community organizations (e.g., churches, after school programs), and recruitment fairs held in Chinatown shopping centers and Asian grocery stores. To achieve the goal of sampling children from both low- and middle-income families, we targeted our recruitment efforts in low-income communities (e.g., Chinatowns) as well as working-class or middle-income communities. During recruitment, the project was described as a research study on Chinese American children's psychological adjustment. Eligibility was based on the following criteria: (a) the child was in first or second grade at the time of screening; (b) the child lived with at least one of her/his biological parents; (c) both biological parents were ethnic Chinese; (d) the child was either first generation (born outside the U.S.) or second generation (born in the U.S. with at least one foreign-born parent) Chinese American; and (e) the parent and child were able to understand and speak English or Chinese (Mandarin or Cantonese). Of the 380 children whose parents expressed an initial interest in the study, 353 were screened, and 291 of these children were found to be eligible. Families meeting the eligibility criteria were contacted by phone and invited to participate in the study. Of these families, 258 agreed to participate and completed the assessment. Of this number, 63.6% were recruited at recruitment fairs in communities, 19% were recruited through agency referrals, and 17.4% were recruited through schools.

**Assessment.** The child and one parent participated in a 2.5-h laboratory assessment consisting of interviews, questionnaires, and/or psychological testing. The parent and child were assessed in separate rooms by bilingual, trained undergraduate research assistants. Parents and children were administered the assessments in their

preferred language (English, Mandarin, or Cantonese). All written materials (including consent and assent forms and questionnaires) were available in English, simplified Chinese, or traditional Chinese. The child's mother was invited to participate in the assessment, and if the mother was not available, the child's father was invited. As a result, 81.8% of children in this sample had mothers as the participating parent, whereas 18.2% of children had fathers as the participating parent. The majority of parents (83.7%) completed the questionnaires in Chinese, whereas 16.3% of parents completed the questionnaires in English. In contrast, the majority of children (93.0%) completed the self-regulation assessments and math achievement tests in English, whereas 7.0% of children completed these assessments in Chinese. The English literacy tests were administered in English regardless of the child's preferred language. Parents were paid for participation and children were given a small prize.

After obtaining written parent permission, the child's current classroom teacher was contacted by the research staff and asked to complete a set of questionnaires on the child's behaviors at school. Teacher questionnaires were sent and returned via mail, and teachers were paid for their participation. Teacher questionnaires were collected for 85.3% of children and all teacher questionnaires were completed in English. A total of 156 teachers participated in the study, with each teacher filling out the questionnaire for between one and ten students (77.6% of teachers filled out the questionnaire for only one student).

#### Measures

In the present study, the Chinese versions of parent questionnaires were translated and tested in previous studies of native Chinese or Chinese immigrant families (Chen & Tse, 2010; Zhou, Lengua, & Wang, 2009; Zhou et al., 2008). The verbal instructions for child assessments (including the Puzzle Box Task, the Go/No-Go Task, the Cognitive Flexibility Task, and the math achievement tests) were translated, back-translated, and piloted following the procedures outlined by Knight, Roosa, Calderón-Tena, and Gonzales (2009). The performance of children who received verbal instructions in English was compared to the performance of children who received instructions in Chinese ( $N_s = 228$  vs. 17 for Puzzle Box, 229 vs. 17 for Go/No Go, 228 vs. 16 for Cognitive Flexibility, and 239 vs. 18 for math achievement) and no differences were found. Thus, the child's language use during assessment did not influence their task performance.

#### Effortful control (EC)

**Parents' and teachers' reports of EC.** The child's parent and teacher each completed the Attention Focusing and Inhibitory Control subscales of the Children's Behavior Questionnaire (CBQ; Rothbart, Ahadi, Hersey, & Fisher, 2001). Items were rated on a 7-point scale ranging from 1 (*extremely untrue*) to 7 (*extremely true*). Parental and teacher reports of the two subscales showed satisfactory internal and test-retest reliabilities in previous studies of European American and native Chinese children (Eisenberg et al., 2005; Zhou et al., 2008). In the present sample, the alphas for inhibitory control were 0.70 for parents and 0.80 for teachers; the alphas for attention focusing were 0.73 for parents and 0.87 for teachers. Moreover, previous cross-cultural comparisons of Chinese and U.S. samples showed similarities in both the relations between attention focusing and inhibitory control and the relations between these EC components and children's behavioral problems (Zhou et al., 2009). Consistent with the perspective that inhibitory control and attention focusing are two theoretically related components of EC (Rothbart & Bates, 2006), the inhibitory control and attention focusing subscale scores were moderately to highly correlated



within reporters in positive directions in this sample,  $r_s = 0.52$  and  $0.68$  ( $N_s = 251$  and  $215$ ), for parents' and teachers' reports, respectively,  $p_s < 0.001$ . Thus, following the procedures typically used in other studies using the CBQ (Muhtadie, Zhou, Eisenberg, & Wang, 2013; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005), an EC composite was computed by averaging the item scores across the two subscales. The  $\alpha$ s for the combined EC scales were 0.80 (parent report, 22 items) and 0.91 (teacher report, 22 items).

**Observed behavioral persistence.** Children's behavioral persistence, an observational index of EC tapping both attention focusing and inhibitory control (Zhou et al., 2007), was assessed with a puzzle box task (Eisenberg et al., 2001, 2005) in which they were instructed to assemble a wooden puzzle in a large box without looking inside the box. Although a cloth blocked the child's view of the puzzle, the child could easily "cheat" during the task by lifting the cloth. Children were left alone in the room for up to 5 min while completing the task, and were videotaped by a visible video camera. Two trained undergraduate students independently coded the videos for the number of seconds the child persisted on the puzzle without cheating or going off-task (inter-rater  $r = 0.97$  in this sample). Children's behavioral persistence was calculated as the proportion of time persisting on the task (i.e., time persisting divided by the total time spent on the puzzle, see Eisenberg et al., 2001). In a longitudinal study of predominantly European American children, the behavioral persistence score on this task showed satisfactory rank order stability from middle to late childhood and loaded positively on the latent factor of EC together with parent and teacher report of attention focusing and inhibitory control (Eisenberg et al., 2005).

**Go/No-Go task.** Children were administered a computerized version of the Go/No-Go task (Eriksen & Eriksen, 1974). A low rate of omission errors (i.e., failing to press the button in response to the target stimulus) on this task is thought to reflect sustained attention, while a low rate of commission errors (i.e., responding to non-target stimuli) is generally thought to reflect inhibition (Barkley, 1991; Halperin et al., 1988). Total numbers of omission and commission errors were used in the analysis as indicators of low EC.

**Cognitive flexibility.** A computerized task was modified from a measure originally developed by Baym, Corbett, Wright, and Bunge (2008) to assess children's cognitive flexibility, the ability to quickly adapt behaviors to changing cognitive demands. As cognitive flexibility also requires inhibition of a prepotent response (i.e., repetition of a preceding response) cognitive flexibility and similar constructs (e.g., executive control) have been previously conceptualized as a type of EC (Li-Grining, 2007). At the same time, cognitive flexibility can also be distinguished from other measures of EC (e.g., the behavioral persistence measure used in the present study) because it also involves components of working memory (Liew, 2012; Li-Grining, 2007). Target stimuli were cartoon characters colored in shades of red or blue. Cartoons faced either in a leftward or rightward direction, with slight variations in the angle of orientation from trial to trial. Children were instructed to use one of two visually presented rule cues (the word "Color" or "Direction") to determine the appropriate button response to each stimulus. Color and Direction trials were intermixed randomly, thereby requiring children to switch flexibly between rules. The task was administered in a practice session (32 trials) followed by a testing session (98 trials). The rule cue for each stimulus was either the same (Repeat) or different (Switch) from that of the previous trial. Furthermore, the color and direction features of the stimulus were either associated with the same response (Congruent) or conflicting responses (Incongruent). Thus, the task taps children's ability to switch flexibly between task instructions, while ignoring the irrelevant stimulus feature (Color or Direction, depending on the currently relevant rule).

Performance on Incongruent-Switch trials is a sensitive measure of cognitive flexibility, because accurate performance on these trials is only possible when participants have switched flexibly from one rule to the other and are successful at ignoring the stimulus dimension that was relevant on the immediately preceding trial (Baym et al., 2008). By contrast, accurate performance on Congruent trials does not necessarily mean that the participant is following the correct rule, and accurate performance on Repeat trials does not require task-switching. Thus, the accuracy percentage on Incongruent-Switch trials (correct responses divided by total number of trials) was used in the analyses as an indicator of cognitive flexibility.

**Factor structure of EC.** Consistent with the theory of an integrated model of self-regulation (Zhou, Chen, et al., 2012), most of our EC measures were correlated with each other in the expected direction with the exception of parent-reported EC (which was correlated with teacher-reported EC, but not with observed EC measures). However, the sizes of the correlations between parent-reported EC and observed EC measures (absolute values of  $r_s = 0.08$ – $0.13$ ) in our sample were similar to those reported among children of European American and other ethnic backgrounds (Blair & Razza, 2007; Spinrad et al., 2012). Similar to the present findings, Blair and Razza (2007) found nonsignificant correlations between parent-reported EC and lab-based measures of inhibitory control and attention shifting in an ethnically diverse sample of preschool- and kindergarten-age children. Thus, the low correlations between parent-reported EC and lab-based EC measures are not unique to Chinese American children. To examine the factor structure of EC in the present sample, we conducted confirmatory factor analysis to test a single-factor model of EC, which was based on previous work using similar EC measures with preschool to early school-age children (Allan & Lonigan, 2011; Sulik et al., 2010). The model was estimated with Mplus 6.12 (Muthén & Muthén, 1998–2011). The model fit the data well,  $\chi^2$  ( $df = 8$ ,  $N = 258$ ) = 6.15,  $p = 0.63$ ,  $CFI = 1.00$ ,  $RMSEA = 0.000$ ,  $SRMR = 0.027$ . All the model-estimated loadings were significant in the expected direction, with the absolute values of standardized loadings ranging from 0.30 (parent-reported EC) to 0.52 (cognitive flexibility). These results supported the convergence of EC measures in Chinese American children.

**Academic skills.** To assess children's academic skills in math calculation and English literacy, subtests from the Woodcock–Johnson Tests of Academic Achievement III (WJ III ACH; Woodcock, McGrew, & Mather, 2001) were individually administered to children during the lab assessment. For math calculation, the Math Calculation Skills Cluster was administered, which consists of the Calculation (solving arithmetic computations with increasing difficulty) and Math Fluency (performing simple calculations within a time limit) subtests. For English literacy, the Basic Reading Skills Cluster was administered, which consists of the Letter-Word Identification (naming and reading words from a list) and Word Attack subtests (the ability to read non-words). The WJ III ACH has demonstrated good psychometric properties, with reliabilities at 0.80 or above for the individual subtests in ethnically diverse samples (Woodcock et al., 2001). The WJ III ACH is standardized with a mean score of 100 and a standard deviation of 15. In the present analyses, the age-standardized scores were used.

#### Family factors (parent report)

**Family SES.** Parents filled out a demographic survey during the lab assessment. Questions regarding the mother's and the father's highest levels of education (number of years) and total family income in the past year were adapted from the Family Demographics and Migration History Questionnaires used in a large study of adolescents from immigrant families (Roosa et al., 2008).

**Table 1**

Descriptive statistics of study variables.

	N	Min	Max	Mean	SD	Skew	Kurtosis
Effortful Control (Parent Report)	253	2.73	6.18	4.65	0.68	−0.09	−0.23
Effortful Control (Teacher Report)	215	1.83	6.87	5.04	0.95	−0.61	0.21
Behavioral Persistence (% Time Persisting on the Puzzle Task)	245	0.05	1.00	0.82	0.22	−1.47	1.45
Go/No-Go Omission Errors	246	0	62	5.68	8.75	3.46	14.27
Go/No-Go Commission Errors	246	0	46	9.61	6.48	1.34	3.72
Cognitive Flexibility (% Accuracy on Incongruent-Switch Trials)	242	0.43	0.97	0.74	0.14	−0.30	−0.71
Basic Math Calculation Skills (Stand. Score)	257	55	179	126.48	15.79	0.13	1.99
Basic Reading Skills (Stand. Score)	257	79	144	113.95	10.41	−0.16	0.95
Child Age	257	5.81	9.14	7.38	0.71	0.07	−0.82
Child Generation Status <sup>a</sup>	258	0	1	0.76	0.43	−1.25	−0.45
Mother's Education	253	3	20	13.03	2.47	0.28	1.12
Father's Education	251	0	20	13.20	3.00	0.21	1.78
Family Per Capita Income	248	625	50000	11609	528	1.34	2.02
Parent Acculturation	247	−1.16	2.09	0.00	0.61	0.54	0.01
Parent Enculturation	254	−1.98	1.15	0.00	0.50	−0.89	2.44
Authoritative Parenting	254	2.00	4.93	4.07	0.48	−0.60	1.37
Authoritarian Parenting	252	1.26	4.61	2.15	0.43	1.40	4.55

<sup>a</sup> Child generation status was coded as: 0 = 1st generation, 1 = 2nd generation.

**Authoritative and authoritarian parenting.** Parents rated their own parenting styles using the authoritative and authoritarian scales of the Parenting Styles and Dimensions Questionnaire (PSDQ, Robinson, Mandleco, Olsen, & Hart, 1995). The Chinese version of the PSDQ has been previously used with Chinese populations and had satisfactory internal reliabilities (Wu et al., 2002; Zhou et al., 2008). The factor structures of the two scales were shown to be invariant between Chinese and American samples (Wu et al., 2002). The authoritative scale includes four subscales: warmth/acceptance, reasoning/induction, easy-going/responsiveness, and encouragement of child's democratic participation. The authoritarian scale includes four subscales: non-reasoning/punitive strategies, corporal punishment, verbal hostility, and directiveness. For each item, parents used a 5-point scale to rate how often they exhibit this behavior with the child (from 1 = "Never" to 5 = "Always"). Composite scores of authoritative and authoritarian parenting styles were formed by averaging the corresponding item scores. The alpha reliabilities in this sample were 0.90 and 0.78 for authoritative parenting (27 items) and authoritarian parenting (19 items), respectively.

**Parents' acculturation and enculturation.** The English version and Chinese translation of the Culture and Social Acculturation Scale (CSAS; Chen & Lee, 1996; Chen & Tse, 2010) were used to measure parents' self-reports of their own acculturation to American culture and enculturation to Chinese culture. The CSAS consists of 32 items that belong to two subscales (Acculturation/American Orientation, and Enculturation/Chinese Orientation), and has been used to study Chinese immigrant children and parents (Chen & Tse, 2010; Garrett-Peters & Fox, 2007). Regarding internal consistency, one study demonstrated alphas of 0.77 and 0.59 for parents' American orientation and Chinese orientation subscales, respectively (Garrett-Peters & Fox, 2007). The CSAS items assess the level of social and behavioral adherence to the American and Chinese cultures in the domains of language fluency (e.g., "How well do you understand spoken English?"), media use (e.g., "How often do you read Chinese newspapers?"), and social affiliations (e.g., "How many Chinese friends do you have?"). The composites for acculturation and enculturation were computed as the averages of standardized item scores in the corresponding subscales. For the present sample, the alphas were 0.87 for the acculturation subscale and 0.73 for the enculturation subscale.

## Results

### Preliminary analyses

The sample descriptive statistics for all study variables (child and family characteristics, EC measures, and academic achievement) are presented in Table 1. Variables were screened for univariate normality. Using the respective cutoffs of two and seven for skewness and kurtosis (West, Finch, & Curran, 1995), all the study variables were normally distributed with the exception of the number of omission errors on the Go-No Go task, which was slightly positively skewed (suggesting that most children made few omission errors). Thus, we used robust estimation in structural equation modeling. The full correlation matrix for all study variables is presented in Table 2. Children's age and generation status (but not gender) were associated with both EC measures and academic achievement and were therefore included as covariates in the hypothesized models.

### Effortful control as a mediator in the relations between family factors and achievement

**The full model.** A structural equation model (Fig. 1) was specified to test the hypothesized relations among child and family characteristics, child EC, and children's academic achievement. This model contained two latent factors: (a) the latent factor of Family Socioeconomic Status (SES), indicated by mother's and father's levels of education and family's per capita income; and (b) the latent factor of child EC, indicated by the six individual measures. In this model, child demographics (age and generation status), family characteristics, including the latent factor of Family SES, parents' (mostly mothers') acculturation and enculturation, and parenting styles were hypothesized to predict the latent factor of EC, which in turn predicts children's math calculation skills and English literacy skills. The direct paths from child and family characteristics and children's math and English literacy skills were also estimated in the model. The model was estimated with Mplus 6.12 (Muthén & Muthén, 1998–2011) using full information maximum likelihood to handle missing data and the Maximum Likelihood Robust (MLR) estimator for adjustment to correct standard errors for nonnormality (Muthén & Muthén, 1998–2011). The predictors (child age, generation status, family SES, parent's acculturation and

**Table 2**  
The correlation matrix of all study variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. EC-P	–																
2. EC-T	0.23**	–															
3. EC-PS	0.13	0.16*	–														
4. EC-OE	–0.10	–0.16*	–0.18**	–													
5. EC-CE	–0.08	–0.23**	–0.14*	–0.02	–												
6. EC-CF	0.12	0.18*	0.20**	–0.26***	–0.21**	–											
7. Literacy	0.25***	0.18**	0.08	–0.02	–0.05	0.17**	–										
8. Math	0.12	0.33***	0.23***	–0.15*	–0.21**	0.28***	0.38***	–									
9. Age	–0.03	0.04	0.29***	–0.14*	–0.15*	0.31***	–0.19**	0.28***	–								
10. Gender	–0.04	–0.20*	–0.14*	0.14*	0.05	–0.17*	–0.03	0.07	–0.06	–							
11. Gen	0.14*	0.04	–0.02	0.16*	0.01	–0.03	0.20**	–0.04	–0.06	–0.06	–						
12. ED-M	0.17**	0.01	–0.05	0.10	–0.01	–0.01	0.27***	0.07	–0.17**	–0.04	0.11	–					
13. ED-F	0.14*	–0.02	–0.06	0.11	–0.05	0.06	0.20**	0.04	–0.08	–0.01	0.14*	0.58***	–				
14. Income	0.09	–0.03	–0.14*	0.14*	0.02	0.04	0.21**	0.01	–0.16*	–0.02	0.24***	0.55***	0.56***	–			
15. ACC-P	0.16*	0.00	–0.15*	0.13*	–0.02	–0.02	0.26***	0.03	–0.13*	0.01	0.16*	0.53***	0.46***	0.53***	–		
16. ENC-P	0.11	0.04	0.09	–0.04	–0.11	0.01	–0.05	0.01	0.00	0.08	0.07	–0.10	–0.04	–0.09	–0.04	–	
17. PS-AT	0.38***	–0.11	–0.10	0.01	–0.05	–0.13*	0.04	–0.10	–0.12	0.05	0.12	0.13*	0.16*	0.13*	0.26***	0.27***	–
18. PS-AR	–0.25**	–0.17*	–0.04	0.04	–0.02	–0.10	–0.08	–0.02	–0.04	0.10	–0.10	–0.11	–0.06	–0.08	–0.04	–0.03	–0.08

Notes: 1. EC-P = parent-reported effortful control, 2. EC-T = teacher-reported effortful control, 3. EC-OE = go/no-go omission errors, 4. EC-CE = go/no-go commission errors, 5. EC-PS = persistence on puzzles, 6. EC-CF = cognitive flexibility, 7. Literacy = basic English reading skills, 8. Math = math calculation skills, 9. Age = child age (in years), 10. Gender = child gender (0 = females, 1 = males), 11. Gen = child generation status (0 = 1st generation, 1 = 2nd generation), 12. ED-M = maternal years of education, 13. ED-F = paternal years of education, 14. Income = family per capita income, 15. ACC-P = parent acculturation, 16. ENC-P = parent enculturation, 17. PS-AT = authoritative parenting style, 18. PS-AR = authoritarian parenting style.

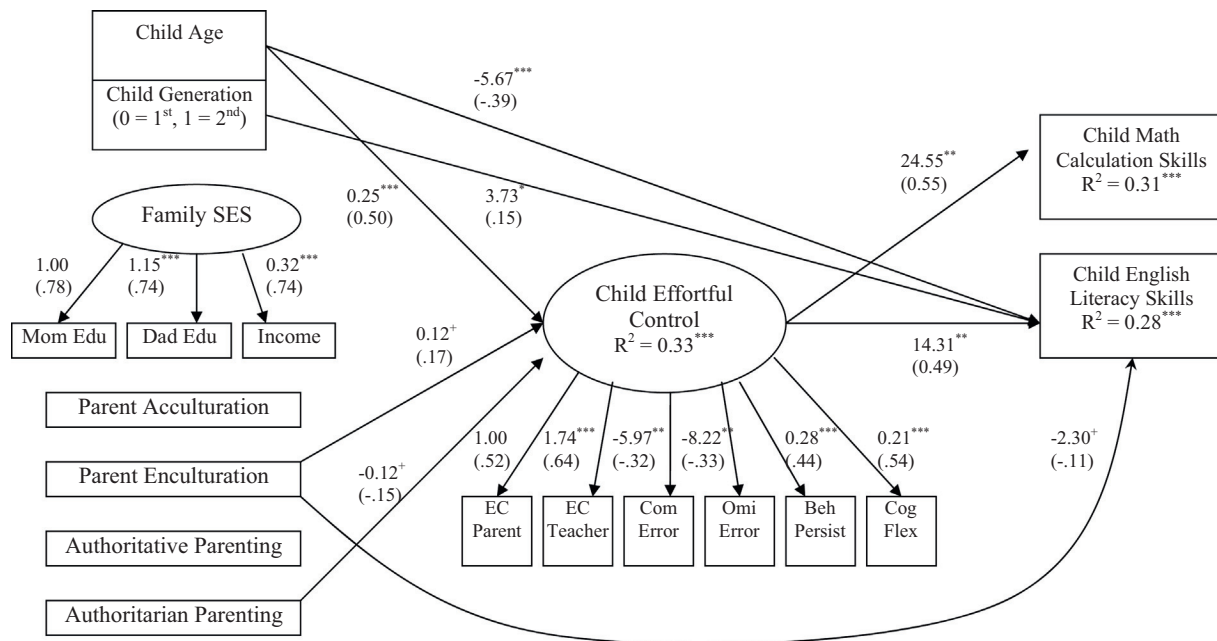
enculturation, and parenting styles) were allowed to be correlated with each other, as were the two achievement variables. To improve the model fit, the error terms of the following pairs of variables were correlated with each other: (a) numbers of omission and commission errors on the Go/No-Go task, model estimated  $r = -0.14, p = 0.037$ , (b) child age and teacher's report of EC,  $r = -0.30, p = 0.002$ , and (c) parents' report of authoritarian parenting and parents' reports of child EC,  $r = 0.16, p < 0.001$ .

Hu and Bentler (1999) recommended the cutoffs of comparative fit index (CFI)  $\geq 0.95$ , root mean square error of approximation (RMSEA)  $\leq 0.06$ , and standardized root-mean-square residual (SRMR)  $\leq 0.08$  as the criteria for a relatively good overall model fit. Based on these criteria, the hypothesized model fit the data well,  $\chi^2 (df = 90, N = 258) = 105.21, p = 0.13, CFI = 0.98, RMSEA = 0.026$ , and SRMR = 0.058. The model-estimated loadings of the individual measures for the two latent factors (Family SES and EC) were statistically significant and in the expected direction. Three child and family characteristics uniquely predicted EC: child age significantly and positively predicted EC; parents' enculturation marginally and positively predicted EC, and parents' use of authoritarian parenting marginally and negatively predicted EC. Together, the child and family characteristics accounted for 33% of variance in EC. EC, in turn, positively predicted children's math calculation skills and English literacy skills. In addition, we found three direct paths from child and family characteristics to academic achievement: (a) a significant and negative direct path from child age to English literacy; (b) a significant and positive direct path from child generation status (0 = 1st, 1 = 2nd) to English literacy; and (c) a marginally significant and negative path from parent's enculturation and English literacy. The model accounted for 31% of variance in children's math calculation skills and 28% of variance in children's English literacy skills.

Testing indirect relations. Based on the estimated model shown in Fig. 1, mediation analyses were conducted to test whether child EC mediates the relations between: (a) parent enculturation and children's math and English literacy skills; and (b) authoritarian parenting and children's math and English literacy skills. The indirect/mediated effects were estimated using the bias-corrected bootstrap confidence interval approach (MacKinnon, Lockwood, & Williams, 2004). There were two significant indirect effects: (a) the indirect path from parent's enculturation to children's English literacy via EC, the 95% confidence interval (CI) = [0.237, 4.263]; and (b) the indirect path from parent's enculturation to children's math calculation skills via EC, 95% CI = [0.402, 6.960]. In addition, there were two marginally significant indirect effects: (a) the indirect path from authoritarian parenting to children's English literacy via EC, 90% CI = [–6.365, –0.418]; and (b) the indirect path from authoritarian parenting to children's math skills via EC, 90% CI = [–6.365, –0.418].

Testing effortful control as a moderator in the relation between SES and achievement

Multiple-group analysis (by EC groups) was conducted to test the hypothesis that EC moderates the associations between SES and academic achievement. First, we created a composite index of EC by averaging the standardized scores of the individual indicators (the standardized scores for omission and commission errors were multiplied by –1 before computing the composite). Second, based on a median-split on the EC composite, we classified the sample into a higher-EC group and a low-EC group. Third, a modified model from Fig. 1 (with the EC factor and its individual variables omitted) was estimated simultaneously in the higher-EC and lower-EC groups. Two models were compared: the model in which the two paths from SES to children's achievement were constrained to be invariant across groups, and the model in which the two paths



**Fig. 1.** Effortful control as a mediator in the relations between child or family characteristics and children's academic achievement.

*Notes.* Solid lines or arrows represent significant paths and loadings. Nonsignificant paths from child and family characteristics and child effortful control, math and English literacy skills were estimated in the model but omitted in the graph. The numbers outside the parentheses are unstandardized loadings or path coefficients, and the numbers inside the parentheses are standardized loadings or path coefficients. Abbreviations for variables included in the model: EC Parent = parent-reported effortful control, EC Teacher = teacher-reported effortful control, Com Error = commission error on the Go/No-Go Task, Omi Error = omission error on the Go/No-Go Task, Beh Persist = % of time persisting on the puzzle task, Cog Flex = % of accuracy on the incongruent-switch trials of the cognitive flexibility task, Mom Edu = mother's education level, Dad Edu = father's education level. \*\*\* $p \leq 0.001$ , \*\* $p \leq 0.01$ , \* $p \leq 0.05$ , + $p \leq 0.10$ .

were allowed to vary by EC groups. The Chi-square difference test between the two models was non-significant,  $\Delta\chi^2(df=2) = 3.413$ ,  $p = 0.18$ . Thus, no evidence of moderation was found.

## Discussion

To our knowledge, the present study represents the first empirical test of the direct and indirect relations between family contextual factors, children's EC, and academic achievement in children from immigrant families. Moreover, by focusing our investigation on Chinese American immigrant children, our study extends previous research by examining the unique contributions of cultural and parental influences to children's EC and academic achievement. More broadly, by integrating person characteristics (i.e., EC), proximal processes (i.e., parenting), and family contextual factors (i.e., SES and cultural orientations), the present study demonstrates how key components of the bioecological model (Bronfenbrenner & Morris, 2006) can contribute directly and indirectly to the academic achievement of children in immigrant families.

Overall, the results demonstrate the direct links between EC and the early academic achievement of first- and second-generation Chinese American immigrant children, as well its potential role in mediating family contextual influences on children's academic achievement. Moreover, our results indicated that family cultural factors (e.g., parents' enculturation) can influence immigrant children's academic development through multiple pathways: while parents' enculturation may limit children's exposure to the English language, it may also indirectly benefit children's achievement through promoting their EC. Together, our results reveal that there are complex relations between family ecological factors and immigrant children's academic development, and they also underscore the key role of EC in these associations.

### Links of effortful control to academic achievement

Consistent with previous research with Chinese and primarily European American samples (Valiente et al., 2011; Zhou et al., 2010), EC was positively associated with children's math and English literacy achievement. Because EC involves complex psychological processes that may manifest differently in different settings (e.g., school vs. home), integrating parents' and teachers' reports with lab-based neuropsychological and behavioral tasks can provide a more accurate and ecologically valid assessment of this construct than a single measure or method of assessment. It is important to note that although confirmatory factor analysis of the EC measures in the present CA sample provided some support for the single-factor model of EC, measurement equivalence (in factor loadings, intercepts, and variances) by culture cannot be tested because we did not have a comparison sample in a different cultural group (e.g., non-Hispanic whites). Thus, an important direction of future research on EC development in immigrant children is to evaluate cultural similarities and dissimilarities in EC structure and measurement.

### Links of family contextual factors to children's effortful control and achievement

**Family SES.** In our sample, indicators of family SES (parental education and income) were positively correlated with children's English literacy achievement, but were unrelated to children's math achievement. Moreover, there were few significant correlations between family SES and measures of EC, and tests of EC as a protective factor against low-SES were non-significant. These results are somewhat inconsistent with the large body of literature on the adverse effects of family poverty or low-SES on children's development (Yoshikawa, Aber, & Beardslee, 2012). One potential explanation comes from previous work indicating that



Asian American children from low-income immigrant families who lived in ethnic communities (e.g., Chinatown) may benefit from the academic and social support from the ethnic, cultural, and religious resources (e.g., ethnic language schools, after-school programs, churches, ethnic community centers) in the community (Zhou & Kim, 2006). Because this is one of the few samples of Asian American school-age children that included similar proportions of children from low-income and middle-income families, we believe replicating the findings with other Asian American samples is important before drawing further conclusions.

*Parenting styles.* No direct associations were found between parental use of authoritative and authoritarian parenting and Chinese American children's academic achievement. Consistent with hypotheses and previous research with mainland Chinese and primarily European American populations (Eisenberg et al., 2005; Zhou et al., 2004), authoritarian parenting was negatively correlated with parent and teacher ratings of EC, and marginally and negatively associated with the latent factor of EC in the full model. Although authoritative and authoritarian parenting have been associated with Chinese American children's psychological adjustment in previous studies (Chen, Hua et al., 2014), the associations between these parenting styles and Chinese or Asian American children's academic outcomes during early elementary school have not been extensively studied. It is possible that children's academic skills (especially those captured by standardized achievement tests) are more directly associated with parenting practices supporting children's education and learning activities (i.e., parent involvement) than global parenting styles such as authoritative or authoritarian parenting.

Although authoritarian parenting had no direct relations to children's achievement, tests of indirect relations indicate that authoritarian parenting may negatively impact Chinese American immigrant children's achievement by hindering children's EC. As such, this finding helps to further elucidate a long-standing debate in the literature: namely, why authoritarian parenting is inconsistently associated with negative academic outcomes in Chinese American children (Dornbusch, Ritter, Leiderman, Roberts, & Fraleigh, 1987; Steinberg, Lamborn, Darling, Mounts, & Dornbusch, 1994). While some researchers have argued against the applicability of authoritarian parenting styles to Chinese American families (Chao, 1994), our findings suggest that the links between authoritarian parenting and Chinese American students' academic achievement could be indirect and thus less detectable. Specifically, authoritarian parenting may negatively affect children's academic skills by hindering their capacity to focus attention, inhibit dominant responses, and persist on a difficult task.

Contrary to our hypothesis that authoritative parenting would facilitate children's development of EC, authoritative parenting was mostly unrelated to children's EC in the present sample. In a previous study of native Chinese children, Lee, Zhou, Eisenberg, and Wang (2013) also found few cross-reporter correlations between authoritative parenting and school-aged children's EC (in contrast to the significant correlations between authoritarian parenting and EC). Thus, it appears that the benefit of positive parenting on EC is less evident than the harmful effect of negative parenting. However, it is unclear whether this result can be replicated in non-Chinese children or children in other age groups (e.g., toddlers or preschoolers), which is an important direction for future research.

*Parents' acculturation and enculturation.* Although parents' acculturation (i.e., engagement in American culture) was positively correlated with children's English literacy skills, parents' acculturation did not have unique relations to children's achievement or EC. By contrast, parents' enculturation (i.e., engagement in Chinese culture) had a unique and direct negative relation with children's English literacy. These associations are consistent with the positive associations found between immigrant parents' English proficiency

(an important domain of acculturation for immigrants in the U.S.) and children's achievement in nationally representative samples (Han et al., 2012) as well as with another community sample of young children from Chinese American immigrant families (Liu, Benner, Lau, & Kim, 2009). Together, these findings suggest that Chinese American children from less-aculturated families may need extra support in areas of English language and literacy development, particularly if they are less exposed to English at home, or if their families are unable to provide direct support in these academic domains (Han et al., 2012).

In addition to its direct association to children's English literacy, parents' enculturation had significant indirect relations to children's math and English literacy achievement via EC. The marginally significant positive association between parents' enculturation and children's EC is somewhat consistent with the existing work on cultural differences in EC or executive functioning development (Lan et al., 2011; Oh & Lewis, 2008; Sabbagh et al., 2006). It suggests that parents' engagement in Chinese culture may confer some benefits for children's development of self-regulation, likely due to the greater cultural valuing of and expectation for well-regulated and controlled behaviors in children (Zhou et al., 2009). However, because we did not examine parents' culture-specific values, beliefs, or socialization practices that support or encourage children's EC, the exact mechanisms through which parental enculturation shapes children's EC remain unknown. This is an important direction for future research on EC development in immigrant children.

It is interesting to note that the direct and indirect relations between parents' enculturation and children's achievement were in opposite directions: a negative direct relation (i.e., higher parent enculturation associated with children's lower English literacy), and a positive indirect relation (i.e., higher parent enculturation indirectly associated with children's higher achievement via EC). This pattern, known as "inconsistent mediation" (MacKinnon, Krull, & Lockwood, 2000), points to the complex nature of the processes through which family cultural factors shape immigrant children's academic development. While parents' ties with the heritage culture in some domains (e.g., language use and proficiency) might create constraints or obstacles for children's academic development in certain areas, heritage culture engagement in other domains (e.g., cultural practices promoting EC) might benefit children's overall academic development and wellbeing in the long-term.

Although age was not a key focus of the study, we found that children's age negatively predicted their age-standardized scores of English literacy achievement. This result is somewhat consistent with Han's (2008) findings using data from the Early Childhood Longitudinal Study, Kindergarten Class (ECLS-K): although children of East Asian origin had higher reading and math scores compared to non-Hispanic White children from kindergarten to 3rd grade, they showed decreasing scores over time, thus narrowing their initial score advantage in achievement over non-Hispanic White children.

#### *Additional study limitations and future directions*

In addition to the limitations discussed above, there are a few other limitations of this study. First, given the cross-sectional design, it is not possible to test the directionality of the relations among constructs, and the tests and estimates of indirect/mediated effects might be positively biased with cross-sectional measures. More broadly, a more comprehensive application of bioecological models would also consider how individuals and their surrounding ecological systems change over time (Bronfenbrenner & Morris, 2006). Indeed, it is important to keep in mind that these cross-sectional relations reflect only a particular developmental period in children's acquisition of these academic skills. As such, it

is important to extend this model to a longitudinal sample of Chinese American children. Second, due to sample size limitations, the study is underpowered for detecting moderation effects. Third, because the sample was drawn from a metropolitan area with a high concentration of Chinese Americans, the findings may not generalize to Chinese immigrant families living in other geographical areas. Thus, it is critical to replicate these findings with other Chinese or Asian American samples. Fourth, because we only assessed children's basic reading skills and math calculation skills, our study may not capture the role of EC in other academic domains (e.g., reading comprehension and math reasoning). Future studies should further investigate the role of EC in the development of more complex and advanced academic skills and the underlying mediating mechanisms.

### Implications for education and intervention

Given the established links between EC and children's academic achievement in the early school years, it is not surprising that EC or self-regulation has become a popular target for educational and intervention efforts aimed at promoting academic success, especially for children at risk for academic problems (Blair & Diamond, 2008; Ursache et al., 2012). Results of this study suggest that intervention programs promoting EC can benefit Chinese American children of immigrant families. Specifically, our findings point to a few directions for promoting EC in Chinese American children. First, interventions can target parenting practices by educating and training Chinese American immigrant parents to reduce the use of coercive, overly strict, and punitive parenting practices and encourage the use of supportive parenting behaviors (Zhou, Chen, Cookston, & Wolchik, 2014). Second, interventions can utilize immigrant families' "cultural assets" by supporting their heritage cultural values and practices that promote children's self-regulation (Luo et al., 2013). Third, given associations between children's generation status, parent enculturation and children's English literacy skills; first-generation immigrant children and children of less acculturated parents may need additional English language support during early school grades. In sum, culturally competent interventions for children of immigrant families should attend to these family-level risk factors while supporting and promoting their existing strengths.

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