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The linear and nonlinear effects of organized extracurricular activities on Chinese Preschoolers' development

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ABSTRACT

How children spend time outside of school has consequences for their learning and development. Research on extracurricular participation has focused primarily on school-aged children and youth in Western societies. Yet, extracurricular activities are a common but understudied context of early development in Mainland China. In the present study, we employed the developmental model and the threshold model as a lens to examine the linear and nonlinear impact of extracurricular participation on three domains of development among 695 Chinese preschoolers. There are three main findings. First, there was partial support for the linear effect model (i.e., the developmental model). After controlling for demographic variables and children's prior performance, extracurricular involvement was positively associated with children's cognitive and language development, but not to social-emotional development. Second, there was also partial support for the overscheduling hypothesis (i.e., the threshold model). The results showed a quadratic effect of intensity, breadth, and total number of extracurricular activities on children's social-emotional development, as well as a quadratic effect of the breadth of extracurricular participation on children's language development. Finally, we extended the traditional overscheduling hypothesis by examining how duration of extracurricular involvement interacted with three other dimensions of involvement. The results suggest that increasing the *number* or *intensity* of extracurricular activities would benefit children's language development when participation duration was relatively short. However, these influences became neutral at average levels of duration and harmful in cases of very long duration. Implications of our findings are discussed.

1. Introduction

Early childhood experiences have important consequences for later development (Shonkoff & Phillips, 2000). Parental effort to provide children with rich, stimulating environments to optimize their developmental outcomes is widespread but particularly pronounced in rapidly developing societies such as China, where children face fierce competition at all levels of education (Kuan, 2015). To give their children a competitive edge over their domestic and global peers, many Chinese parents enroll children in diverse extracurricular activities (EAs) at an early age (Yi, 2013). On evenings and weekends, it is not unusual to see parents shuffling their children from one EA to another, sustaining a booming education industry in China (Deloitte China, 2016). Similar trends are prevalent in other parts of Asia, such as Hong Kong, Taiwan, Japan, Korea, and India (Chen & Lu, 2009; Lau & Cheng, 2016; Mori & Baker, 2010).

Although EAs have emerged as a key developmental microsystem within and beyond Chinese contexts, little research has examined the characteristics of EAs and how these characteristics jointly and interactively influence child development. In this study, we investigated how different facets of EA participation (e.g., breadth, intensity, content types) influence the development of Chinese preschoolers, thereby extending and enriching the existing scholarship that has primarily focused on extracurricular participation among school-aged children and youth, particularly in Western societies (Chiu & Lau, 2018).

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1.1. The impact of EA participation on child and youth outcomes: The developmental model and overscheduling hypothesis

In this study, we focused on organized EAs[1] that fall outside the regular school curriculum (as opposed to unorganized activities such as watching TV). Mahoney, Larson, and Eccles (2005) defined organized EAs as "[activities] characterized by structure, adult supervision, and an emphasis on skill-building. …These activities are generally voluntary, [and] have regular and scheduled meetings" (p. 4). In Western contexts, organized EAs are often school- or community-based programs. Participation in EAs has been linked to an array of child and youth academic and psychosocial outcomes (Bohnert, Fredricks, & Randall, 2010; Simpkins, Little, & Weiss, 2004).

Five theoretical models have guided research on the influence of EAs on child and adolescent development: the zero-sum model, the developmental model, the identification or commitment model, the threshold model, and the social inequality gap reduction model (see Marsh & Kleitman, 2002 for a detailed review). The zero-sum model postulates that greater extracurricular involvement subverts one's involvement in more narrowly defined academic pursuits, leading to undermined academic outcomes (Marsh, 1992). The identification or commitment model hypothesizes that EA participation promotes academic outcomes through enhancing students' sense of identification with school. The social inequality gap reduction model predicts that participation in EAs will be more beneficial for socioeconomically disadvantaged students than their advantaged counterparts. The zero-sum model has not been widely accepted, as many empirical studies have found positive effects of EA participation on child and youth development, contradicting the zero-sum model (e.g., Aumètre & Poulin, 2018; Mahoney et al., 2005). The identification or commitment model and the social inequality gap reduction model are useful in investigating potential mediators (e.g., school identification) and moderators (e.g., family socioeconomic background) of the effects of EAs on individual outcomes. The goal of the present study was to examine the effects of EA participation on young children's developmental outcomes. We chose the developmental model and the threshold model as a lens to examine the influence of EAs, because these two models specifically address the nature of the direct effects of EAs on individual development.

1.1.1. The developmental model

The developmental model, which posits that EAs provide socialization experiences that can enhance development, is most widely used and has the strongest empirical support. It assumes a positive linear relationship between EA participation and a range of academic and non-academic outcomes (Marsh & Kleitman, 2002). The positive role of EAs can be attributed to several possible mechanisms. First, organized EAs can provide individuals with age-appropriate activities that hold opportunities to develop cognitive as well as social skills (Fredricks & Eccles, 2006a). Second, EAs involve adult supervision and guidance, as well as opportunities "to develop prosocial peer groups and a sense of belonging, a 'hook' into school that may help to keep students enrolled, and increase academic achievement" (Stearns & Glennie, 2010, p. 296). Third, EAs share many similarities with classroom contexts, such as distinct rules, scripts, and goals, which afford socialization experiences to foster the acquisition of skills and knowledge (Larson & Varma, 1999).

Indeed, studies that investigate EAs' influence on Western school-aged children and youth showed that higher levels of participation in EAs were associated with better academic-related outcomes, such as math and reading achievement (Dumais, 2006; Hofferth & Sandberg, 2001; Schuepbach, 2015), grades (Fletcher, Nickerson, & Wright, 2003; Fredricks & Eccles, 2006a, 2006b; Posner & Vandell, 1999), approaches to learning (Covay & Carbonaro, 2010), and school engagement (Piché, Fitzpatrick, & Pagani, 2015). Studies have also linked EA participation to increased social competence (Fletcher et al., 2003; Molinuevo, Bonillo, Pardo, Doval, & Torrubia, 2010; Posner & Vandell, 1999), enhanced wellbeing (Lagacé-Séguin & Case, 2010) and self-esteem (Kort-Butler & Hagewen, 2011), and decreased rates of problematic behavior (Aumètre & Poulin, 2018; Simoncini & Caltabiono, 2012).

Because the developmental model emphasizes how EAs can strengthen a broad set of skills and competencies (as opposed to being limited to a specific content area), it also explains why the positive impact of EA participation cuts across academic and psychosocial domains. For instance, participation in dance lessons was found to be related to children's approaches to learning (Covay & Carbonaro, 2010) as well as gains in math and reading (Dumais, 2006). The developmental model also suggests that children may encounter the "big ideas" of early mathematics, such as counting and pattern recognition, by learning to match tempos with movements in dance lessons (Clements & Sarama, 2009; Rosenfeld, 2011). Children may also learn to pay attention, follow instructions, and apply perseverance through dance lessons, which are domain-general skills that go beyond dancing itself and can benefit development across academic areas (Zhang, Hu, Ren, & Fan, 2017).

1.1.2. The threshold model

Despite abundant evidence demonstrating the positive impact of EA participation, there may be a limit to these benefits. Marsh and Kleitman (2002) proposed the threshold model, which posited a non-linear relationship between EA participation and individuals' development. Specifically, EA participation would yield developmental benefits at moderate levels, but generate diminishing returns or even undermine child wellbeing beyond an optimal point. The threshold model has inspired researchers to test the overscheduling hypothesis. "Overscheduling" implies that excessive involvement in EAs may undermine (rather than enhance) individual wellbeing. Indeed, the concern about overscheduled kids who are overly involved in EAs is widely echoed in media reports and popular books (Feiler, 2013; Thompson & Barker, 2005). Mahoney, Harris, and Eccles (2006) described the conditions under which the overscheduling hypothesis would operate. First, children's EA participation is extrinsically motivated by real or perceived academic pressure from adults to achieve long-term educational and career advantages. Second, EAs dominate children's unstructured free time, taking away opportunities to interact with family members and undermining family functioning and child wellbeing.

Presently, empirical support for the overscheduling hypothesis is limited and relies on Western school-aged samples. Mahoney et al. (2006) found that youth with very high levels of participation in organized EAs tended to have either better or similar adjustment compared to youth who did not participate at all. Fredricks (2012) and Knifsend and Graham (2012) found an inverse, U-shaped relationship between EA participation and academic outcomes in American adolescents. Simoncini and Caltabiono (2012) reported that Australian elementary school children who participated in EAs for 90–180 min per week had the lowest levels of mother-reported social difficulties compared to their counterparts spending more or less time in EAs.

1.2. The association between EA participation and preschool-aged children's development

So far, we know little about the effect of EAs on preschool-aged children's development. Interestingly, the few existing studies come mostly from East Asian populations. Chiu and Lau (2018) focused on a sample of Hong Kong children aged 5–6 years, and found that participation in a larger total number of EAs was related to better adult-reported school readiness and social behaviors, as well as child-reported

[1] In this article, the term "EAs" is used to refer to *organized* (as opposed to unorganized) EAs. The term "organized EAs" was not spelled out every time for simplicity. It is clearly noted when unorganized EAs are mentioned.

cognitive competence and peer acceptance. [Blinded for Review] (2020) reported positive effects of EA participation on the growth trajectories of early math and reading skills among Hong Kong preschoolers from less socioeconomically advantaged families, while EA participation was not related to children's social skills. Chen (2015) found no association between the breadth or the duration of EA participation and teacher-reported school engagement in Taiwanese preschoolers. Indeed, more research is needed to illuminate these mixed findings through clarifying what patterns of EA participation exist and how participation influences multiple developmental domains of young children.

1.3. Importance of studying EA participation in Chinese preschoolers

We propose three reasons for why examining the influence of EA participation on Chinese young children's development is important. First, rates of EA attendance among Chinese preschoolers have increased dramatically, particularly in urban cities. According to a survey of parents with children aged three to six years across 12 cities in Mainland China, approximately two-thirds of preschoolers participated in EAs (Yi, 2013). Similar trends were observed in Taiwan (Chen, 2015) and Hong Kong (Lau & Cheng, 2016). EAs have become a common developmental context for many young Chinese children, although the public opinion of EAs' benefits is divided. Some Chinese parents, like their counterparts in the United States and Europe (Kremer-Sadlik, Izquierdo, & Fatigante, 2010; Smyth, 2016), believe that EAs help children cultivate interests, develop skills, enrich their lives, and give them academic advantages (Lau & Cheng, 2016; Yi, 2013). Other parents are concerned about how busy EA schedules, coupled with expectations for achievement, exert excessive pressure on their children and eventually jeopardize the psychosocial wellbeing of children (Karsten, 2015). So far, the empirical evidence related to this debate remains inconclusive. Indeed, the high participation rate and controversy with respect to its benefits make China an ideal place to critically examine how EA participation influences early development.

Second, the EAs that Chinese preschoolers experience are different from those found in the West. In China, EAs are mostly provided by private companies, whereas organized EAs in Western societies are often publicly-funded programs that are either school- or community-based (Mahoney et al., 2005). A broad range of EAs targeted at preschool-aged children exist in China, often involving structured lectures or activities that are generally beyond the scope of preschool curriculum (Lau & Cheng, 2016). Preschoolers may be considered too young to participate in the decision-making of their EA participation, unlike older children and adolescents who can (at least in part) express their preferences and may even make decisions about how to spend their time after school. This difference in agency may lead to different levels of psychological engagement in the EAs between preschoolers and older children, which may, in turn, produce varied effects for different age groups.

Lastly and most importantly, the existing theoretical models and relevant empirical findings on the influence of EA participation among older children and adolescents cannot be directly generalized to preschoolers: children have unique ontogenetic characteristics in the early years that may limit or magnify the developmental benefits that EAs provide. On one hand, EAs provide children with opportunities to engage in learning activities and interact with similar-aged peers (Covay & Carbonaro, 2010). On the other hand, young children learn primarily through play (Singer, Golinkoff, & Hirsh-Pasek, 2006). Considering that young children, in China and around the globe, already spend large proportions of their day at school on structured activities, unstructured time where children play freely and engage in family activities is more precious than ever (Holloway & Pimlott-Wilson, 2014; Wortham, 2013). Gray (2011) argued that the increased time and emphasis placed on school and other adult-directed, academic-like activities (e.g., EAs) contributed to the decline in children's play in the United States and many other nations.

In China, most urban children attend full-day preschools, where the day is scheduled to begin at 8:00 a.m. and end at 4:00 or 5:00 p.m. When EAs are added to a preschooler's schedule, it takes time away from play, a valuable medium through which children build relationships as well as cultivate and practice important cognitive and social-emotional skills (Gray, 2011; Singer et al., 2006). However, how young children are affected by dense daily schedules remains an open question.

1.4. Measuring EA participation: Levels of involvement and content types

One challenge in evaluating the impact of EAs lies in operationalizing ways to measure participation that captures its multifaceted characteristics (Fiester, Simpkins, & Bouffard, 2005; Simpkins et al., 2004). So far, there is no unified tool or comprehensive set of indicators that adequately describes the essential components of extracurricular participation. In the existing EA scholarship, some studies have focused on the overall levels of EA involvement, while others have attended to the content of the EAs.

Bohnert et al. (2010) proposed four dimensions to evaluate the overall levels of involvement in EAs: breadth, intensity, duration, and engagement. Each dimension represents a unique facet of children's experiences (though they are interrelated), and each has been linke to positive outcomes in children and youth (Fredricks & Eccles, 2006a, 2006b; Mahoney et al., 2006; Schuepbach, 2015; Shernoff, 2010; Simoncini & Caltabiono, 2012). The "breadth" of involvement refers to the number of extracurricular contexts in which children are involved and captures how focused or diverse a child's participation profile is. The "intensity" of involvement is indexed by the amount of time spent in EAs every week (Bohnert et al., 2010). The "duration" of involvement concerns the length of time children have been involved in a particular EA. "Engagement," is in and of itself a multidimensional construct that includes attention, interest, enjoyment, and effort. This component directly relates to children's subjective experiences with the EA but has received the least attention (Weiss, Little, & Bouffard, 2005).

Instead of asking "How much participation is beneficial?", other studies asked "Which EAs are beneficial?" (Farb & Matjasko, 2012) by examining the specific contents of the EAs (e.g., sports). Indeed, EA subjects may have a differential impact on particular developmental outcomes. For instance, Dumais (2006) categorized the content of American elementary school children's EAs into six types: music, dance, performing arts, art lessons, athletic activities, and organized clubs. Her study found that children's involvement in dance lessons, athletic activities, and clubs during kindergarten and first grade predicted their gains in reading between first and third grade, while participation in dance lessons was associated with gains in math.

Measuring multiple facets of extracurricular participation can help unpack the complex relations between EA participation and child outcomes. The above review of the literature suggests that researchers should pay attention to the multiple dimensions of overall EA participation, as well as the specific content of EAs. However, most studies only assessed the levels of EA involvement *or* the content types of EAs, but *not* both. Moreover, studies focused solely on overall involvement often measured only very limited dimensions of EA involvement, restricting our understanding of the complex effects of EA involvement on child development (Bohnert et al., 2010). Therefore, this study addresses the multidimensionality of EA participation by attending to multiple dimensions of overall EA involvement as well as to the content types of EAs.

1.5. The present study

The current study examined both the linear and nonlinear effects of EA participation on child development using data obtained from preschool-aged children in an urban Chinese city. A linear relationship

suggests that two quantities are proportional to each other (e.g., a straight line in a graph), while a nonlinear relationship between two variables reflects that each unit change in one variable will not always bring about the same change in the other variable (e.g., a curved line in a graph). Specifically, we were curious about the extent to which the developmental model (i.e., linear effect model) and the overscheduling hypothesis (i.e., nonlinear effect model) held true for young Chinese children. Because previous research has mainly focused on academic and psychosocial domains (Bohnert et al., 2010), we also included three developmental outcomes—cognitive, language, and social-emotional development—the first two of which capture important precursors of children's future academic achievement (Duncan et al., 2007), while the last concerns the psychosocial domain.

Following Bohnert et al. (2010) recommendation, we used multiple indicators to better capture children's overall EA involvement, including the total number, intensity, breadth, and duration of EAs. We also assessed children's engagement in EAs by asking parents to report how much their child enjoyed participating in EAs. Importantly, this more comprehensive set of indicators allowed us to extend our conceptualization of the overscheduling hypothesis by examining how different dimensions might interact with one another in influencing children's development. We were particularly interested in how the duration of involvement (or the length of time a child has committed to EAs) interacts with the total number, breadth, or intensity of EAs. For instance, a child who participates in many EAs (total number) for a long time (duration) may have different experiences and outcomes in comparison to a peer who participates in only one EA but also for a long time. This reconceptualization of the overscheduling hypothesis goes beyond a static view of overscheduling as a temporary status at a particular point in time by considering for *how long* the child has been overscheduled.

We proposed the following hypotheses: (1) Overall, higher levels of EA involvement (i.e., total number, breadth, intensity, and duration) would be related to better cognitive, language, and social-emotional development in children. Child enjoyment of EAs would also be positively related to child outcomes. (2) The traditional overscheduling hypothesis would be supported. Specifically, at low to moderate levels of extracurricular involvement, EAs would have positive effects on children's development, but the effects would level off at higher levels of involvement. (3) The duration of EA participation would interact with the total number, breadth, and intensity of EAs in relation to children's development.

It is worth noting that no hypothesis was generated for the effect of different content types of EAs on child outcomes. Parents were asked to list all EAs in which their child participated. Since there is no widely-accepted coding scheme in the literature, we would build upon categories of EAs used in previous studies and develop a coding scheme for the present study.

2. Method

2.1. Participants

Participants included 695 preschoolers (52.3% girls) recruited from 12 preschools in Shanghai. Preschools are generally three-year programs in China serving children between three and six years of age. All preschools in this study offer full-day programs (8:00 a.m. to 4:00 p.m.) like most preschool facilities in China. Data were collected at two time points over one year. Children were in the fall semester of either the first (50.9% of the sample) or the second year of preschool when first recruited (Mean age = 49.47 ± 6.57 months). Table 1 presents family demographic information.

Table 1
Demographic information of the sample.

Variables	*M* (*SD*) %
Child age at Time 1 (month)	49.47 (6.57)
Percentage of only child	73.1%
Marital status	
Married	96.95%
Divorced	2.18%
Remarried	0.87%
Maternal education level	
1. Secondary degree or below	10.61%
2. Vocational college degree	21.80%
3. Bachelor's degree	54.36%
4. Master's degree or above	13.23%
Paternal education level	
1. Secondary degree or below	10.17%
2. Vocational college degree	19.04%
3. Bachelor's degree	48.55%
4. Master's degree or above	22.23%
Family monthly income	
1. < 8000 RMB ($1260)	5.96%
2. 8001–15,000 RMB ($2364)	18.46%
3. 15,001–20,000 RMB ($3152)	17.30%
4. 20,001–50,000 RMB ($7877)	42.30%
5. 50,001–80,000 RMB ($12,607)	10.03%
6. > 80,000 RMB	5.96%

2.2. Procedure

Twelve preschools of varying quality were selected from six districts in Shanghai to represent families from different backgrounds, and they all agreed to participate in the study. Classroom teachers helped disseminate project information to parents. All parents were assured that participation in this study was voluntary and that they could withdraw at any time. Two rounds of data with a one-year interval were collected in the fall of 2016 (T1) and 2017 (T2), respectively. The parents (either mother or father) who consented to participate in this study completed questionnaires. At T1, a family demographic questionnaire was sent home for parents to complete. At T2, parents were asked to report their child's current participation in EAs through an online questionnaire. Most parents (92.9%) responded to the online version, and paper-and-pencil questionnaires were sent to parents who did not respond to the online version.

Parents were asked to provide consent for their child to participate in an individually administered test on child developmental outcomes (i.e., the East Asia- Pacific Early Child Development Scales [EAP-ECDS] measurement described below). Trained research assistants administrated this assessment. At both T1 and T2, children participated in this one-on-one assessment. The assessment took about 20–30 min to complete. Children were allowed to take a break at any time during the assessment. Children received a small token (e.g., stickers) for their participation.

2.3. Measures

2.3.1. Demographic information

At T1, parents reported children's birthdates, gender, and family monthly income. They also reported their own as well as their spouse's education levels. Because the levels of maternal and paternal education were highly correlated ($r = 0.69$, $p < .001$), we created the variable "parental education" by averaging the education levels of the father and the mother within a family (see Table 1 for the four levels of education). Family monthly income was coded into six categories (see Table 1). Both parental education and family income were included as covariates in further analyses.

2.3.2. Child developmental outcomes

The short-form EAP-ECDS (Rao et al., 2014, 2019) was adopted to assess children's cognitive development, social-emotional development,

and language and emergent literacy at both time points. The EAP-ECDS is a one-on-one assessment that was developed to evaluate the development of young children in the East Asia-Pacific region. It has been validated in six countries, including China (Rao et al., 2014). To increase the efficiency of data collection, Rao et al. further developed the short form by extracting a subset of items from the original instrument. We used three subscales of the short form: *Cognitive Development* (27 items), *Social and Emotional Development* (18 items), and *Language and Emergent Literacy* (22 items). Items in the Cognitive Development subscale mainly pertain to math (e.g., counting, addition, and subtraction, story problem solving, knowledge in shapes) and executive functions (e.g., working memory, cognitive flexibility) (sample item: Assessor presents 30 blocks in front of the child and asks the child to put out 15 blocks on a piece of paper.). Items in the Social and Emotional Development subscale pertain to etiquette, social comprehension, emotional recognition, and perspective-taking skills (sample item: Assessor shows a picture in the testing booklet to the child and asks: Children are clapping for this girl. How do you think she feels?). The Language and Emergent Literacy subscale mainly assesses children's emergent reading and writing skills (sample item: Assessor asks the child to look at the Chinese characters in the testing booklet and read out loud the ones that he/she knows.).

This assessment was administrated by 12 graduate and undergraduate research assistants majoring in psychology or early childhood education. Research assistants were thoroughly trained on the administration of the assessment during a one-day workshop, and they were required to complete a practice session before actual data collection to make sure that their scoring was completely aligned with the standardized scoring criteria. Every time they encountered a response from children that was not covered by the established scoring criteria, they were asked to make a note. The principle investigators of this research project discussed those responses until reaching a consensus on scoring. The Cronbach's alphas were 0.89 (T1) and 0.87 (T2) for Cognitive Development, 0.90 (T1) and 0.86 (T2) for Language and Emergent Literacy, and 0.81(T1) and 0.82 (T2) for Social and Emotional Development.

2.3.3. Children's extracurricular participation

At T2, parents reported the EAs in which their child was taking part at the time of the study. Because parents were usually the ones that made decisions about EA enrollment for children of such young ages, we relied on parents' reports to obtain information about children's EA participation. In previous studies, a common method was to provide parents or children with a checklist of activities (e.g., Dumais, 2006; Molinuevo et al., 2010). However, it was challenging to create an exhaustive list of EAs in this study, because EAs for young Chinese children are remarkably diverse. Thus, we decided not to use a predetermined list. Rather, we asked parents to list every EA that their child was involved in and to provide the following information on each EA: the content, the weekly frequency of participation, the number of hours spent on each EA per week, and the duration of involvement in each EA by the time of data collection. Parents also reported their perceptions of how much their child liked each EA using a 5-point Likert scale (1 = not at all; 5 = very much). The content of each EA was coded into one of the 10 categories presented in Table 2. We referred to the studies by Fredricks and Eccles (2006a, 2006b) and Chen (2015) to determine the coded categories. Four coders, including the first author and three research assistants, coded parents' responses. Responses from 10% of the sample were coded by two coders, and Cohen's kappa coefficients were calculated. The inter-rater agreement ranged from 79.2% to 100% for the ten coded categories, with an average agreement of 95.3%.

We used several indicators to measure children's extracurricular participation, referring to Bohnert et al. (2010) recommendations. We assessed the ***intensity*** of participation by calculating the total number of hours children spent on EAs every week. As parents reported the amount of time that their child spent on each EA every week, we simply added up the amount of time across all EAs to create the intensity variable. We counted the ***total number of EAs*** children participated in. We examined the ***breadth*** of participation by considering the total number of activity contexts children were involved in. Like Fredricks and Eccles (2006a, 2006b), we combined the four kinds of art activities (i.e., music, dancing, performing arts, other art) into a single "art" category. Thus, seven types of activity contexts were included: art, English, academic learning, sports, chess, integrated early educational programs, and other EAs. The variable breadth was operationalized as the total number of activity contexts out of those seven coded types that a child was involved in. Children's ***duration*** of participation was assessed by calculating the average months of participation across all EAs. Children who did not participate in any EAs received a score of zero on the total number, breadth, intensity, and duration of EAs. We calculated children's ***enjoyment of EAs*** by averaging parents' responses across all reported EAs. Children with no EA participation received missing values on the enjoyment of EAs and were thus excluded from analyses related to this dimension of EAs. Finally, we also looked at the effect of the ***content types*** of EAs (see Table 2 for the seven types of EAs described above). Dummy variables were created to indicate whether a child participated in each type of EA.

2.4. Data analysis plan

The three child-level outcomes (cognitive development, social-emotional development, and language and emergent literacy, collected at T2 using the EAP-ECDS) were modeled jointly using Bayesian multivariate hierarchical models implemented via the brms software package (Bürkner, 2017) in R 3.4.3 (R Core Team, 2017). Bayesian methods are becoming more popular across disciplines with the introduction of user-friendly software (e.g., brms package). Compared to traditional frequentist models, Bayesian models provide more information about model parameters (e.g., McElreath, 2016), correctly quantify and propagate uncertainty in those parameters (e.g., Kruschke, 2014), and are able to estimate models which would otherwise fail (Eager & Roy, 2017). Our data were multilevel (i.e., students nested within classrooms) and multivariate (i.e., multiple outcomes measured per child). Because the outcomes are positively correlated, joint modeling affords us more powerful statistical inference in the form of smaller standard errors (e.g., Snijders & Bosker, 1999). The nested design of this study was taken into consideration by including classroom-level random intercepts for each outcome. Taken together, these data features made the task of modeling multiple outcomes while simultaneously considering the nested nature of the data too complicated for traditional frequentist models, and therefore, we relied on Bayesian estimation.

Because some of the dimensions of overall extracurricular involvement were highly correlated (see Appendix A), we tested one dimension at a time to avoid inferential issues associated with collinearity. Posterior median estimates and credible confidence intervals (CI) were presented in Tables 4–6. Child performance on the EAP-ECDS at T1 was included in the models as a covariate to better delineate the effects of EAs on child development. In all the estimated models, the following child-level variables were also included as covariates: child gender, child age at T2, parental education, and family monthly income. In addition, initial exploratory analyses revealed non-trivial left-skewness in model residuals if a normal distribution was assumed. We thus allowed the residuals to follow a skew-normal distribution, where the outcome-specific shape parameters that controlled the degree of skewness were modeled by the data (Azzalini & Capitanio, 1999).

2.4.1. Linear effects models

In our analyses, we first examined the linear effects of the total number, breadth, intensity, duration, and child's enjoyment of EAs on the three EAP-ECDS outcomes (see Appendix B for detailed information

Table 2
Coded categories of extracurricular activities and rates of participation in the sample.

Activity content type	Description & examples	Percentage
Art	All four types of art activities are described below, including music, dancing, performing art, and other art activities.	59.2%
	Music: Activities related to music, such as learning musical instruments, phonology, and chorus.	20.9%
	Dancing: Activities with a focus on dancing, such as ballet.	26.4%
	Performing arts: Activities such as theater, crosstalk, and modeling.	2.1%
	Other art activities: All other kinds of activities, which include drawing, painting, crafting, clay, etc.	35.2%
English	English lessons.	54.0%
Academic-oriented EAs	This category includes any activity that has a focus on academic learning, such as classes on learning Chinese characters, math, and science, storytelling, programs on logic training (e.g., *siwei xunlian*; *luoji siwei*), lego, and school readiness programs (i.e., *youxiao xianjie ban*).	32.3%
Sports	Athletic activities, such as soccer, swimming, roller skating, and taekwondo.	18.9%
Chess	Chess or Chinese chess.	4.7%
Integrated educational program	Integrated programs focused on early education.	1.2%
Other EAs	Other activities other than the above categories, such as emotional intelligence training.	1.8%

Note. EA: Extracurricular activity.

about the statistical methods). We then examined how children's participation in different types of EAs was related to their development, where participation was dummy coded as: 0 = no participation; 1 = participation. We included only four types of activities: art, English, academic-oriented EAs, and sports. The other three types of EAs (chess, integrated educational programs, other EAs) were not included because of the small number of participants (i.e., less than 5%). However, it is worth noting that including these three types of EAs in the analyses did not change the results.

2.4.2. Quadratic (nonlinear) effects models

Next, we tested the traditional overscheduling hypothesis by examining the quadratic effects of the total number, breadth, intensity, and duration of EAs on the three child outcomes. Similar to the linear effect models, each dimension of the overall EA involvement was tested one-at-a-time to avoid the collinearity issue. We did not test the overscheduling hypothesis for child enjoyment of EAs, because individual interest has been frequently linked to positive learning outcomes (Renninger, Hidi, Krapp, & Renninger, 2014). We found no existing studies that supported a quadratic effect of children's interest in learning activities on their learning outcomes.

2.4.3. Interaction models

We extended the traditional overscheduling hypothesis by testing

Table 4
Standardized Linear Regression Coefficients (and 95% Credible Intervals) of the Effects of Overall Extracurricular Involvement on Time 2 Child Outcomes Adjusted for Child-Level Covariates and Classroom Random Intercept.

Predictor	T2 CD	T2 SED	T2 LEL
Intensity of EAs	0.19 (−0.04, 0.43)	0.00 (−0.19, 0.19)	0.02 (−0.23, 0.27)
Total number of EAs	0.27* (0.01, 0.52)	0.07 (−0.12, 0.25)	0.12 (−0.13, 0.37)
Breadth of EAs	0.36* (0.13, 0.60)	0.13 (−0.04, 0.31)	0.13 (−0.09, 0.37)
Duration of EAs	0.40* (0.17, 0.64)	0.04 (−0.12, 0.21)	0.34* (0.10, 0.57)
Child enjoyment of EAs	0.09 (−0.14, 0.32)	−0.04 (−0.19, 0.11)	0.0.13 (−0.08, 0.35)

Note. CD: Cognitive development. SED: Social-emotional development. LEL: Language and emergent literacy. EA: Extracurricular activity. Multivariate models were estimated with T2 CD, T2 SED, and T2 LEL simultaneously specified as the dependent variables. Other predictors for each outcome also included: child gender, child age at Time 2, parental education, family income, the respective outcome assessed at Time 1, and a classroom-level random intercept. Coefficients with an asterisk represent statistical significance at a 95% confidence level.

Table 3
Correlations between Child Outcomes at Time 2 and Demographic Variables and Different Facets of Extracurricular Participation.

	M (*SD*)	T2 CD 21.09 (4.60)	T2 SED 14.34 (3.33)	T2 LEL 16.68 (4.53)
Child age at Time 2 (month)	61.43 (7.02)	0.57***	0.37***	0.56***
Child gender	–	−0.02	−0.07	−0.13**
Parental education	2.76 (0.79)	0.19***	−0.01	0.11**
Family income	3.50 (1.24)	0.17***	0.02	0.08*
T1 CD	16.36 (5.40)	0.70***	0.30***	0.56***
T1 SED	11.64 (3.81)	0.35***	0.45***	0.31***
T1 LEL	11.53 (5.56)	0.64***	0.38***	0.68***
Intensity of EAs	3.41 (2.76)	0.24***	0.07	0.16***
Total number of EAs	2.08 (1.52)	0.28***	0.12**	0.20***
Breadth of EAs	1.72 (1.14)	0.30***	0.13**	0.19***
Duration of EAs	8.24 (7.02)	0.38***	0.16***	0.35***
Child enjoyment of EAs	4.20 (0.70)	0.01	−0.02	0.04
Art	–	0.15***	0.13**	0.16***
English	–	0.20***	0.06	0.12**
Academic-oriented EAs	–	0.16***	0.02	0.09*
Sports	–	0.18***	0.10*	0.06
Chess	–	0.09*	0.03	0.08*
Integrated educational program	–	−0.01	−0.02	−0.003
Other EAs	–	0.06	0.01	0.02

Note. CD: Cognitive development. SED: Social-emotional development. LEL: Language and emergent literacy. EA: Extracurricular activity. Child gender was dummy coded (0 = girl, 1 = boy). Art, English, Academic-oriented EAs, Sports, Chess, Intergraded educational program, and Other EAs were all dummy coded (0 = no participation; 1 = participation). $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 5
Unstandardized Regression Coefficients (and 95% Credible Intervals) of the Effects of the Content Types of Extracurricular Activities on Time 2 Child Outcomes Adjusted for Child-Level Covariates and Classroom Random Intercept.

Predictor	T2 CD	T2 SED	T2 LEL
Art	0.20 (−0.28, 0.68)	0.37* (0.07, 0.69)	0.38 (−0.09, 0.83)
English	0.02 (−0.44, 0.48)	−0.07 (−0.39, 0.25)	−0.06 (−0.53, 0.42)
Academic-oriented EAs	0.41 (−0.05, 0.90)	0.12 (−0.22, 0.47)	0.25 (−0.21, 0.71)
Sports	0.80* (0.24, 1.36)	0.28 (−0.14, 0.71)	−0.28 (−0.86, 0.32)

Note. CD: Cognitive development. SED: Social-emotional development. LEL: Language and emergent literacy. EA: Extracurricular activity. Multivariate models were estimated with T2 CD, T2 SED, and T2 LEL specified as the dependent variables simultaneously. Other predictors for each outcome also included: child gender, child age at Time 2, parental education, family income, the respective outcome assessed at Time 1, and a classroom-level random intercept. Coefficients with an asterisk represent statistical significance at a 95% confidence level.

how different dimensions of overall EA involvement might interact with one another in predicting children's development. Rather than testing all possible two-way interactions between any two of the dimensions, we focused on the interactions between the duration of involvement and other dimensions (i.e., the total number, breadth, intensity of EAs), as they represented the cumulative effect of different levels of EA involvement on child development. This was an intuitive extension because the burden placed on the child and the family from intensive involvement in EAs might accumulate over time to produce undesired outcomes.

3. Results

Eighty-four percent of the children in the sample participated in at least one EA. As presented in Table 2, 59.2% of the children participated in art-related activities, 52.9% in English classes, 32.3% in academic-oriented activities, and 18.9% in sports. Table 3 presents the descriptive statistics and correlations between EA participation and child outcomes. The total number, breadth, and duration of EAs were all positively correlated with children's cognitive, language and emergent literacy, and social-emotional development. The only exceptions were between the intensity of EAs and child social-emotional development and between child enjoyment of EAs and all child outcomes.

3.1. Testing the developmental model

Table 4 presents the linear effects of EAs on child development. As described previously, children's prior achievement as well as child and family demographic variables (i.e., child gender, child age, parental education, and family income) were included as covariates. The total number, breadth, and duration of EAs showed positive effects on children's cognitive development. The strongest association for this outcome was for the duration of EAs, followed by the breadth and the total number of EAs. The duration of EAs was also positively associated with children's development of language and emergent literacy. None of the dimensions of EA involvement was linearly associated with children's social-emotional development. Children's enjoyment of EAs was not significantly related to any child outcome.

Table 5 presents how participation in EAs of different content types was related to child outcomes. Three trends are worth noting. First, children who participated in sports-related EAs had higher levels of cognitive development than their peers who did not. Second, children who participated in academic-oriented EAs tended to have better cognitive development than their peers who did not, but the effect was only marginal (i.e., significant at the 90% credible interval level). Third, children enrolled in art-related EAs had better social-emotional development compared to their non-participating peers.

3.2. Testing the traditional overscheduling hypothesis

We tested the overscheduling hypothesis by examining the potential quadratic effects of EA involvement on the three child outcomes. The diagonal of Table 6 presents the quadratic coefficients for each dimension of overall EA involvement. For instance, the top left cell displays the quadratic coefficient of the total number of EAs on the three domains of child outcomes, and the bottom right cell shows the quadratic coefficients of duration on child outcomes.

There is partial support for the traditional overscheduling hypothesis. The top panel of Fig. 1 presents the statistically significant quadratic effects of EA involvement on children's social-emotional development, controlling for all other predictors. The positive influence of EAs on children's social-emotional development leveled off when children were involved in more EAs, when their intensity of participation was relatively high, or when the breadth of EAs was high. A similar

Table 6
Standardized Regression Coefficients (and 95% Credible Intervals) for Significant Quadratic Effects (Diagonal Cells) and Interactions between Different Dimensions of Overall Extracurricular Involvement (Off Diagonal Cells) on Time 2 Child Outcomes Adjusted for Child-Level Covariates and Classroom Random Intercept.

Predictor	Total number of EAs	Intensity of EAs	Breadth of EAs	Duration of EAs
Total number of EAs	T2 CD: NS T2 LEL: NS T2 SED: −0.56 (−0.97, −0.14)			
Intensity of EAs	T2 CD: NS T2 LEL: NS T2 SED: −0.14 (−0.28, 0)	T2 CD: NS T2 LEL: NS T2 SED: −0.42 (−0.76, −0.03)		
Breadth of EAs	T2 CD: NS T2 LEL: −0.21 (−0.41, −0.02) T2 SED: −0.18 (−0.32, −0.03)	T2 CD: NS T2 LEL: NS T2 SED: NS	T2 CD: NS T2 LEL: −0.73 (−1.34, −0.05) T2 SED: NS	
Duration of EAs	T2 CD: NS T2 LEL: −0.29 (−0.55, −0.01) T2 SED: NS	T2 CD: NS T2 LEL: −0.29 (−0.56, −0.04) T2 SED: NS	T2 CD: NS T2 LEL: NS T2 SED: NS	T2 CD: NS T2 LEL: NS T2 SED: NS

Note. CD: Cognitive development. SED: Social-emotional development. LEL: Language and emergent literacy. EA: Extracurricular activity. NS: Non-significant at a 95% confidence level. Multivariate models were estimated with T2 CD, T2 SED, and T2 LEL specified as the dependent variables simultaneously. Other predictors for each outcome also included: child gender, child age at Time 2, parental education, family income, the respective outcome assessed at Time 1, and a classroom-level random intercept. The diagonal cells contain the quadratic effect coefficients of the dimensions of overall EA involvement. The off-diagonal cells contain the coefficients for the interaction effects between different dimensions of overall EA involvement on child outcomes. Only statistically significant effects are presented in this table.

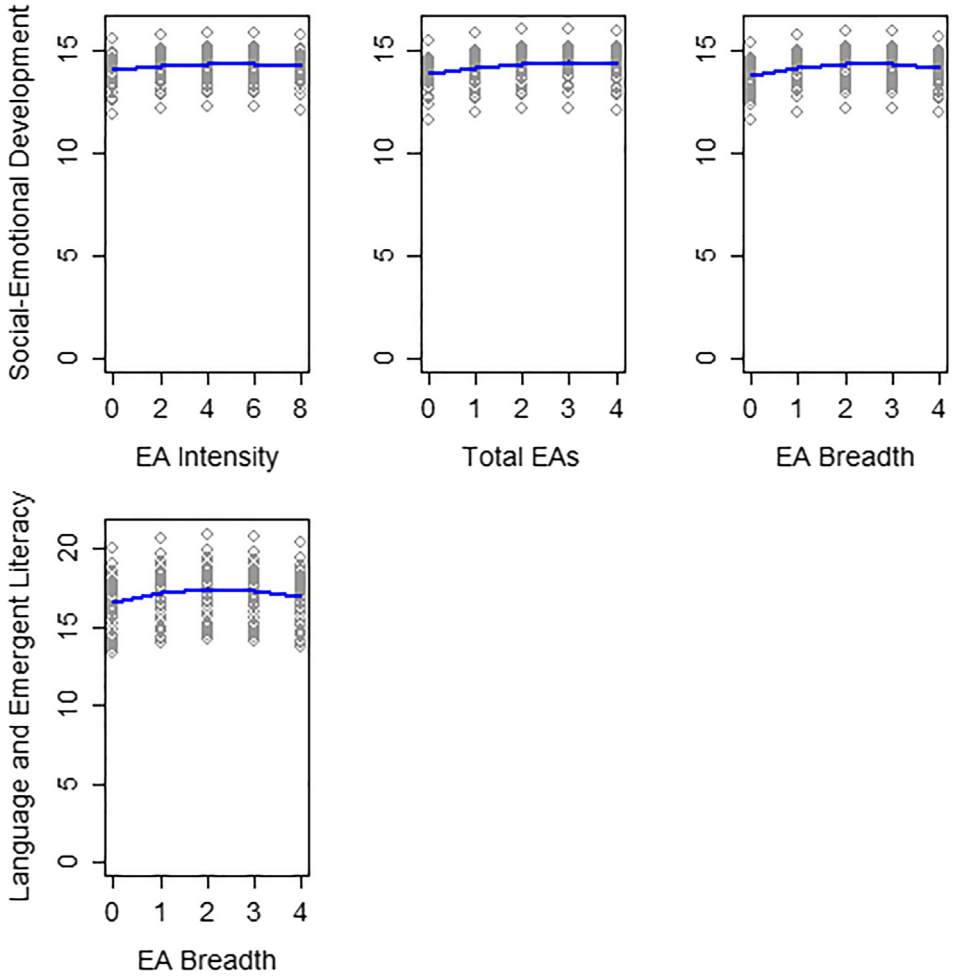

Fig. 1. The quadratic effects of extracurricular participation on children's social-emotional and language and emergent literacy development at Time 2. Points represent classroom-level fitted data. *Note.* EA: Extracurricular activity.

pattern was found for the relation between the breadth of EAs and children's language and emergent literacy development (as seen in the bottom panel of Fig. 1). The pattern of results in Fig. 1 suggests that there was little added value to children's social-emotional or language and emergent literacy development with increasing levels of involvement in EAs beyond the inflection point for each outcome.

3.3. Testing the reconceptualized overscheduling hypothesis

We extended the traditional overscheduling hypothesis by examining whether different dimensions of overall EA involvement would interact with one another in affecting child development, with particular attention to the interaction between the duration of EA participation and other dimensions of overall EA involvement. In Table 6, the off-diagonal cells showed the interaction effects between different measurements of overall EA involvement (i.e., between-measurement interaction). All statistically significant between-measurement interaction effects were negative, and they all occurred for either social-emotional development or language and emergent literacy. These findings indicate support for the reconceptualized overscheduling hypothesis.

The strongest between-measurement interactions occurred between duration and intensity and between duration and the total number of EAs. Fig. 2 depicts the differential effects of EA intensity and total EAs on children's language and emergent literacy, depending on the duration of EA participation. Three levels of duration were plotted: one month (i.e., one standard deviation below the mean), eight months (i.e., around the mean of the sample), and 15 months (i.e., one standard deviation above the mean). For children who had participated in EAs for one month on average, both intensity and total number of EAs had a positive association with children's language and emergent literacy. For children whose average duration of EA participation was eight months, neither intensity nor the total number of EAs was associated with children's language and emergent literacy. However, for children participating in EAs for 15 months on average, attendance intensity and the total number of EAs had negative associations with child language and emergent literacy.

4. Discussion

Extracurricular participation has become increasingly prevalent among preschool-aged children, yet little research has examined its influence on development in the early years. The current study is one of the first to explore the impact of EAs on Chinese preschoolers' holistic development. We examined the extent to which the developmental model and the threshold model applied to young children. The findings from this Chinese population may have important implications for Western societies as the commercialization and institutionalization of childhood is becoming a worldwide phenomenon (Holloway & Pimlott-Wilson, 2014).

4.1. Overall EA involvement and child outcomes: The developmental model

The linear relationship between overall EA involvement and the

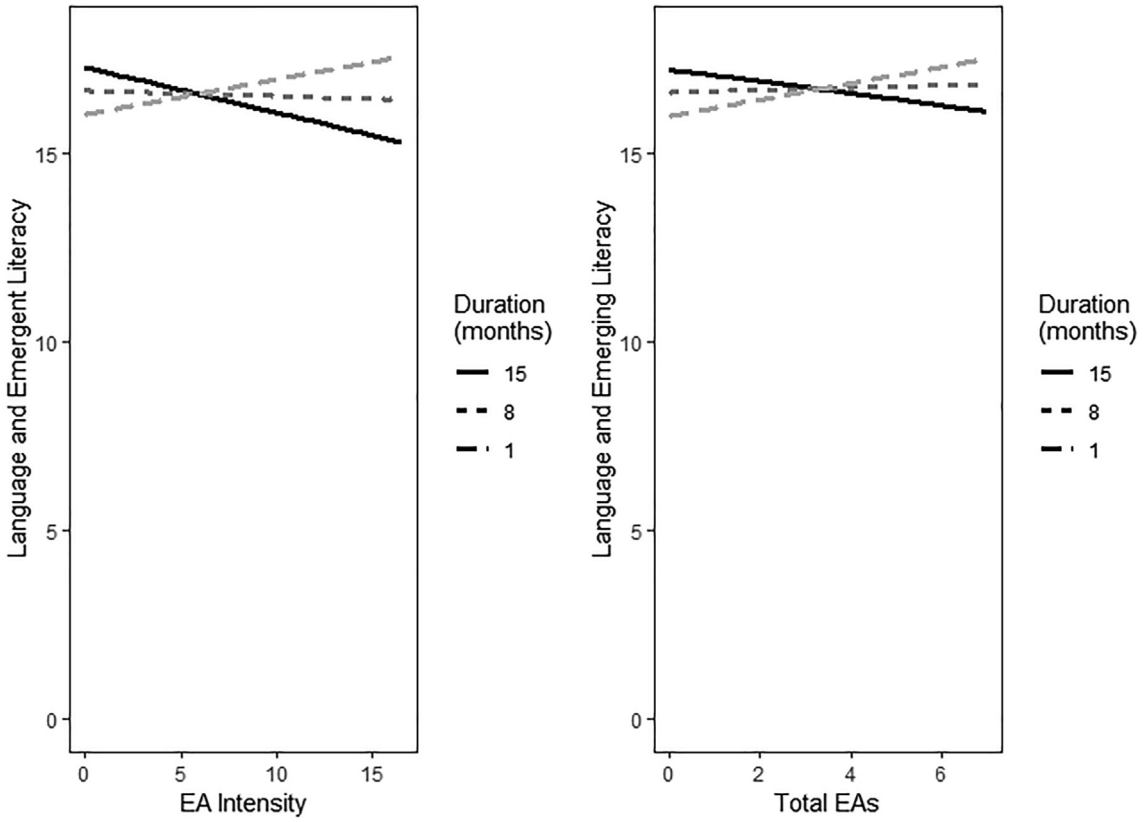

Fig. 2. Differential effects of the intensity and total number of EAs on children's language and emergent literacy at Time 2 at three different levels of duration of extracurricular involvement in months. Lines represent fitted data averaged across classrooms. *Note.* EA: Extracurricular activity. The line for 15 months represents a high level of duration (about 1 *SD* above the mean); the line for 8 months represents a mean level of duration (around the mean); and the line for 1 month represents a low level of duration (about 1 *SD* below the mean).

three child outcomes partially confirms the developmental model (Marsh & Kleitman, 2002). Specifically, the total number, breadth, and duration of EAs were positively associated with children's cognitive development, while the duration of EAs was also positively associated with children's language and emergent literacy. However, overall involvement in EAs was not related to children's social-emotional development, and child enjoyment of EAs was not associated with any outcome. In the analyses, we controlled for children's prior achievement, classroom-level variance, and child and family demographic variables. Linear effects of EA involvement still emerged, providing rigorous evidence in support of the benefits of EA participation on Chinese preschoolers' cognitive and language development. Our results corroborate previous patterns of findings on school-aged children and youth, such that the total number, breadth, and duration of EA participation have all been positively linked to better academic outcomes (e.g., Bohnert et al., 2010; Dumais, 2006; Schuepbach, 2015; Simpkins et al., 2004). These findings were also consistent with those reported by Chiu and Lau (2018) and [Blinded for Review] (2020) regarding the positive associations between EA involvement and overall school readiness and early math and reading skills among Hong Kong preschoolers.

By measuring multiple dimensions of overall EA involvement, the current study provides a more comprehensive portrait of the link between EA involvement and child development. Although most of the dimensions of involvement showed moderate to high correlations with one another (see Appendix B), each indicator measured EA involvement from a different angle, representing the unique experiences of children. Duration of involvement contributed to cognitive as well as language and emergent literacy development, suggesting that the positive effects of EAs can accumulate over time. Studies using school-aged samples have demonstrated the benefits of long-term participation for academic outcomes (e.g., Darling, 2005). It takes time for children to build relationships with adults and peers, as well as to develop skills embedded in the activities (Bohnert et al., 2010; Broh, 2002). Thus, greater continuity of involvement may aid children to better develop cognitive and language skills through sustained exposure to learning activities and interactions with adults and peers. Both the total number and breadth of EAs were positively associated with children's cognitive development. Both indicators reflect the range of contexts that children experience from participating in multiple EAs. Children may encounter a wider range of stimulation and develop a larger learning network by engaging in diverse activities, provoking growth in cognitive skills (Bohnert et al., 2010).

Unexpectedly, the total number of EAs and the breadth of participation were not related to children's language and emergent literacy. We hypothesized that a more diverse profile of EA involvement would provide children with more exposure to different vocabularies, leading to better language and literacy outcomes. This surprising finding may be understood by taking a closer look at the measurement tool. Items in the Language and Emergent Literacy subscale of the EAP-ECDS assess children's emergent reading and writing skills, which are mainly code-related skills that often require formal and deliberate teaching of print (Sénéchal & LeFevre, 2014). However, many EAs may not include direct opportunities for children to practice reading and writing.

In addition, the sheer amount of time spent on EAs every week (i.e., greater intensity) did not relate to more positive outcomes in any domain for this age group. Research on the relations between participation intensity and academic and psychosocial adjustment showed mixed findings among youth, with some showing a positive relation and others revealing a lack of association (Bohnert et al., 2010). Several studies indicated the need to consider how the relation between the intensity of EA participation and child outcomes might vary by moderators such as

the type and quality of the activities (Rose-Krasnor, Busseri, Willoughby, & Chalmers, 2006; Schuepbach, 2015). Moreover, the intensity of participation appears to be a less salient predictor of development compared to other dimensions of EA involvement. For instance, Rose-Krasnor et al. (2006) examined the breadth and intensity of youth participation in EAs simultaneously and found that, although both aspects were positively related to academic orientation and psychosocial wellbeing, the effects of intensity were much smaller relative to breadth. Finally, spending a large amount of time in structured EAs may restrict children's opportunities to engage in unstructured activities, such as free play and family activities, which are of great value for young children's wellbeing (Hofferth & Sandberg, 2001). In recent years, the field of early childhood education has recognized the importance of free play for children's physical, cognitive, and social-emotional development (Milteer, Ginsburg, & Mulligan, 2012). Given that most Chinese urban children are enrolled in full-day preschool programs, participating in EAs at the cost of out-of-school free play may not produce additional benefits for their development.

It is insufficient for children to simply attend EAs—they must be actively engaged to reap their developmental benefits (Bohnert et al., 2010). However, children's enjoyment of EAs, which captures the emotional dimension of engagement, was not associated with any child outcome. We relied on parents' reports to evaluate the extent to which children liked each EA; however, parents' perceptions might not accurately reflect children's own experiences. A child interview, such as the one used by Chiu and Lau (2018), may be a better approach to assess children's enjoyment of EAs and should be considered in future studies.

4.2. Content types of EAs and child outcomes

Surprisingly, academic EAs did not make statistically significant contributions to children's cognitive development after controlling for other types of EAs in the model. One possible explanation is that there was no added value to attending academic EAs because children might have already acquired those cognitive skills from preschool and/or home. It is also possible that the concepts and skills taught in academic EAs might be too advanced and therefore developmentally inappropriate for young children. Indeed, in China, much of the public criticism of EAs for young children pertains to their inappropriateness for children's developmental and interest levels.

Interestingly, children's participation in sports contributed to children's cognitive development. Several studies on school-aged children and youth revealed similar findings. For instance, Broh (2002) reported positive associations between involvement in sports and high school students' grades, and Dumais (2006) found that children's participation in athletic activities contributed to their gains in reading. The positive impact of sports on children's cognitive development supports nascent advocacy for increasing physical activity among young children in China (Shan et al., 2010). A meta-analysis by Sibley and Etnier (2003) showed that physical activity was positively associated with children's cognition. They argued that physical activity could promote cognitive development through physiological mechanisms, such as by increasing cerebral blood flow, modifying brain neurotransmitters, and changing arousal levels. Physical activities requiring the development of control over one's body and mind may also enhance children's executive function skills, which benefits cognitive development (Diamond & Lee, 2011).

Children's participation in art-related activities, on the other hand, was beneficial for their social-emotional development. Children have opportunities to express themselves through visual, musical, or performing arts activities. Indeed, engaging in artistic activities can enhance expressive skills as well as create positive emotional experiences for children (Brouillette, 2010, 2012). Thus, children may have positive affective experiences in art activities, which can promote positive social interactions with peers and adults in the activities and eventually enhance their social-emotional skills. The process of artistic expression also requires children to become more aware of their inner thoughts, desires, feelings, and emotions, which can in turn improve their awareness of other people's emotions and actions (Brouillette, 2010). Meaningful art activities have been shown to promote children's social-emotional skills, such as positive peer interactions, empathy, and conflict resolution (Catterall, 2009; Deasy, 2002). We also speculate that art-related activities may promote children's abilities to take on others' perspectives, as they need to think about how to communicate their ideas to an audience through their preferred aesthetic medium.

4.3. EA participation and child outcomes: The overscheduling hypothesis

We examined the traditional overscheduling hypothesis by testing the quadratic effects of overall EA involvement on child outcomes. Research Hypothesis 2 was partially supported (see Table 6). Similar to research conducted on Western school-aged samples (e.g., Fredricks, 2012; Knifsend & Graham, 2012), the benefits of EA participation for our preschool sample also leveled off. Interestingly, the nonlinear effects of EA participation were most prominent for children's social-emotional development. The findings suggest that the effects of EA involvement on children's social-emotional development would decline when children participate in too many different types of EAs (breadth) or spend too much time in EAs (intensity). High levels of involvement in EAs may take away time from play through which children can learn essential social-emotional skills, such as self-regulation and opportunities to develop conflict resolution skills (Gray, 2011; Singer et al., 2006). Gray (2011) even pointed out that the decline of unstructured free play might lead to the rise of psychopathology in children and adolescents. Intensive participation in EAs may also cause toxic levels of stress in children, which can impair children's social-emotional wellbeing (Fredricks, 2012).

The breadth of participation also had a nonlinear effect on children's language and emergent literacy development. As can be seen in the bottom panel of Fig. 1, participating in an increasingly broad range of activities is not endlessly beneficial for strengthening preschool children's language and emergent literacy skills. As mentioned previously, many of the EAP-ECDS items for the language and emergent literacy outcome assess code-related skills, such as print awareness. While such skills were found to have a strong relation to later reading achievement, their cultivation requires intentional instruction (Sénéchal & LeFevre, 2014). The benefits of instruction may not be present or accessible to children who routinely travel across multiple EA contexts.

Moreover, children need more than incidental exposure to language and print—they need stories, spaces enriched with functional- and play-related print, as well as regular opportunities to talk with and listen to a conversational partner about meaningful topics (Neuman & Dwyer, 2009). Cognitive load theory (Sweller, 1988), grounded in information processing research, may also be instructive when we consider the extent to which the current sample of children have enough time to make sense of and consolidate the novel information introduced across EA settings. For example, repeated read-aloud may facilitate the assimilation of new vocabulary into existing knowledge structures, but such an outcome requires that children have the time they need to make sense of the story through extra-textual talk (Cline & Edwards, 2017) and to ground that understanding in their own lived experiences (Dickinson & Smith, 1994). Thus, as far as the current study goes, language and emergent literacy outcomes may be restricted when children participate in a broad range of EA contexts. While we have offered some possible explanations for this finding, identifying the explanatory mechanisms at play falls outside the scope of this study.

The quadratic effects of EA involvement in the current study were not very strong and consistent relative to studies focused on school-aged children and youth, such as the one conducted by Fredricks (2012), which found that adolescents' academic outcomes started to decline at five or more EAs and 14 or more hours of participation per

week. Mahoney et al. (2006) found that positive effects of EAs on youth outcomes would decline at exceedingly high levels of participation. However, Mahoney and colleagues also found that very few indicators of adjustment would decline to a level significantly lower than that of youth who did not participate in any EA. In other words, any level of participation was still better than no participation. In the current study, very few children (2.4%) participated in five or more EAs; about 10% of the children spent more than 7 h every week in EAs, and only three children spent 14 or more hours on EAs per week. Therefore, exceedingly high levels of EA participation seemed to be relatively rare in the current sample, which constrained the likelihood of discovering curvilinear relations between EA participation and child outcomes.

Next, we reconceptualized the overscheduling hypothesis by attending to the interactions between different dimensions of overall EA involvement, with a particular focus on duration. Research Hypothesis 3 was also partially supported. The negative effects of excessive involvement in EAs became increasingly evident as children's duration of participation increased. We found that the combination of being involved in large numbers of EAs (total number) or spending considerable time (intensity) in EAs every week and being involved in those EAs for a prolonged period of time (duration) posed a risk for children's language and emergent literacy development. As organized EAs often have predetermined goals, continuous high levels of involvement in EAs may constrain the amount of time that children interact with others around topics that interest the children. Interestingly, as shown in Fig. 2, when the duration of participation was short, children benefited from the increasing number or intensity of EAs. This may be because children are often enthusiastic about new experiences and motivated to acquire language and literacy skills characteristic of that EA topic. However, children's interest levels may subside over time, leading to decreased motivation and engagement in EAs.

4.4. Limitations and future directions

The current study should be understood in light of the following limitations. First, many families involved in this study belonged to middle-class (broadly defined). The effects of EA participation may vary across children from different socioeconomic backgrounds: children from working-class families are likely to have different levels of access and experiences with organized EAs of variable quality. Second, the underlying mechanisms of EAs' developmental influences await further exploration. Dumais (2006) proposed several mechanisms based on research on school-aged children, such as parental involvement, social networks, and peer cultures. Fredricks and Eccles (2005) found that the relation between EA participation and positive adjustment in adolescents was partly mediated by affiliations with prosocial peer groups. We propose that EA participation may also impact children's academic and psychosocial outcomes through its influence on the development of self-regulation. Furthermore, in the conceptual framework proposed by Bohnert et al. (2010), program characteristics (e.g., program quality, level of structure) are included as potential moderators of the relations between EA participation and developmental outcomes. Future research needs to include assessments of potential mediating and moderating variables to better delineate how EA participation affects child development. Third, we only focused on children's cognitive, language, and social-emotional development. Both academic and non-academic EAs were common in this study, suggesting that parents' motivations for enrolling their children in EAs were not solely focused on academic achievement. Other domains of development (e.g., self-regulation) should be included as outcomes of interest in future studies.

One strength of this study lies in its comprehensive measurements of EA participation. We followed Bohnert et al. (2010) recommendations to assess multiple dimensions of overall EA involvement. We adapted a coding scheme for categorizing the content types of EAs (see Table 2). This methodology can be applied to children of other age groups, as well as to those from other cultures. However, our measurement approach had two limitations. First, parents reported the extent to which their children enjoyed EAs in this study. Parents usually were not allowed to attend EAs along with their children, so they could not evaluate children's enjoyment through direct observation of their child's emotions and behaviors displayed during EAs. Therefore, parents' perceptions of children's enjoyment might be inaccurate. Future research should incorporate both parent and child perspectives. In addition, parents reported the EAs that their child was participating in at the time of the study. We did not collect retrospective information on EAs that children used to be involved in. In the EA literature, it is common practice to assess children's current EA involvement, but children's history of EA participation may carry a long-term influence on their development. However, this issue may be less severe in the current study which focused on preschool-aged children. Children were five years old on average in this study, and they likely had limited experiences with any particular EA since the commercialized EAs in China often require a long-term investment (similar to a gym membership). Thus, it might be uncommon for children in this study to have participated in many EAs before the time of the study. Nonetheless, it is important to consider both current and past EA participation in future research. Examining children's trajectories of EA participation over time may better capture children's experience with EAs than a one-time assessment.

5. Conclusions and implications

The current study extends EA research from school-aged children and youth to early childhood. Consistent with existing research on school-aged samples, EA participation was found to be beneficial for Chinese preschoolers' cognitive and language and emergent literacy development. However, inconsistent with the literature, EA involvement did not contribute to children's social-emotional development in this study, suggesting the need to reflect critically on the impact of engaging children in structured, out-of-school activities from such an early age. In addition, both the traditional and the reconceptualized overscheduling hypotheses were supported to some extent, which broadened the examinations of curvilinear trends to interactions between various dimensions of EA involvement. Future conceptual and empirical research needs to evaluate "the good, the bad, and the nonlinear" (Marsh & Kleitman, 2002, p. 464) influence of EA involvement on young children's development in various domains, both for individual children and social equality.

The current findings can inform parents, early childhood educators, and policymakers about the potential impact of EAs on early childhood development, especially for those in developing countries that are currently undergoing rapid socioeconomic transitions. Although EA participation can have desirable impacts on child outcomes, parents need to be cautious about the number, breadth, intensity, duration, and type of EAs in which to enroll their children. First, participating in sports could promote children's cognitive development. Yet a lack of physical activity is a growing problem for Chinese children (Shan et al., 2010). In this study, only 19% of the children were enrolled in sports, and boys were found to be more likely to participate in sports than girls. Parents may consider enrolling their children in sports or increasing their child's physical activity to foster cognitive development. Second, academic EAs may have limited added value to children's cognitive development, suggesting that parents and educators need to think critically about the intended outcomes of academic EAs for young children. Furthermore, high levels of involvement in EAs for prolonged periods of time can potentially be detrimental to children's language and emergent literacy development. Given that almost all urban Chinese children already enroll in structured full-day preschool programs, parents and educators should be cautious about overscheduling activities for young children. Third, the benefits of EAs on children's cognitive development come with hefty financial costs in urban China, which may further exacerbate the achievement gap between children

from lower- and higher-SES families. Policymakers may consider providing funding and support to deliver low-cost, high-quality EAs for socioeconomically disadvantaged children as a form of early intervention to reduce socioeconomic gaps in child development.

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Appendix A. Correlations among Dimensions of Overall Extracurricular Involvement

	1	2	3	4
1. Intensity of EAs	–			
2. Total number of EAs	0.84***	–		
3. Breadth of EAs	0.79***	0.90***	–	
4. Duration of EAs	0.33***	0.32***	0.39***	–
5. Child enjoyment of EAs	0.001	−0.03	−0.03	0.04

Note. EA: Extracurricular activity. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Appendix B. Data analysis plan

B.1. Statistical methods

Outcomes of interest in the current study consisted of three child-level EAP-ECDS outcomes collected at time 2: 1) *Cognitive Development* (Y^{CD}), 2) *Social-Emotional Development* (Y^{SED}), and 3) *Language and Emergent Literacy* (Y^{LEL}). These outcomes were modelled jointly using Bayesian multivariate hierarchical models implemented using the brms package (Bürkner, 2017) in R 3.4.3 (R Core Team, 2017). There are several advantages to modelling these outcomes jointly, as opposed to one-at-a-time via univariate hierarchical models. First, hypothesis testing for all model parameters is typically more powerful in a multivariate model, visible in the form of smaller standard errors (Snijders & Bosker, 1999; pgs.199–202). The gain in power can be substantial if the outcomes are positively correlated, as is the case with our data. Second, multivariate models allow us to account for classroom-level (i.e., within-classroom) correlation between outcome-specific random intercepts. It is intuitive to think that classrooms with positive random intercepts for one outcome will tend to have positive random intercepts for the other two outcomes, and vice-versa. In other words, multivariate models allow us to take advantage of the redundancy of classroom-level information carried by the random intercepts. Third, a multivariate analysis matches the nature of the collected data better than a univariate analysis, allowing us to better analyze the totality of information available at both the child and classroom level.

Formally, let $Y_{ij}^{(k)}$ be the kth outcome collected on the ith child in the jth classroom. The multivariate hierarchical models had the following structure:

$$\begin{aligned} Y_{ij}^{CD} &= (\beta_0^{CD} + u_{j0}^{CD}) + \beta_{EA}^{CD} EA_{ij} + \beta_{T1}^{CD} T1CD_{ij} + \\ &\quad \beta_1^{CD} GIRL_{ij} + \beta_2^{CD} AGE_{ij} + \beta_3^{CD} PARENTED_{ij} + \beta_4^{CD} INC_{ij} + \epsilon_{ij}^{CD} \\ Y_{ij}^{SED} &= (\beta_0^{SED} + u_{j0}^{SED}) + \beta_{EA}^{SED} EA_{ij} + \beta_{T1}^{SED} T1SED_{ij} + \\ &\quad \beta_1^{SED} GIRL_{ij} + \beta_2^{SED} AGE_{ij} + \beta_3^{SED} PARENTED_{ij} + \beta_4^{SED} INC_{ij} + \epsilon_{ij}^{SED} \\ Y_{ij}^{LEL} &= (\beta_0^{LEL} + u_{j0}^{LEL}) + \beta_{EA}^{LEL} EA_{ij} + \beta_{T1}^{LEL} T1LEL_{ij} + \\ &\quad \beta_1^{LEL} GIRL_{ij} + \beta_2^{LEL} AGE_{ij} + \beta_3^{LEL} PARENTED_{ij} + \beta_4^{LEL} INC_{ij} + \epsilon_{ij}^{LEL} \end{aligned}$$

where β_0 are the population intercepts, u_{j0} are the random intercepts for the jth classroom, EA is one of the previously-described dimensions of extracurricular participation (i.e., the total number of EAs, intensity, breadth, duration, and child enjoyment), and $T1CD$, $T1SED$, $T1SED$ are values of the three outcomes at Time 1. Measures of extracurricular participation were tested one-at-a-time, with posterior median estimates and credible confidence intervals presented in Tables 4. Models were further adjusted for other child-level covariates, namely: whether the child is a girl ($GIRL$), age in months (AGE), parental education ($PARENTED$), and family income (INC). Finally, ϵ^{CD}, ϵ^{SED}, ϵ^{LEL} are the outcome-specific residual terms with variances σ_{CD}^2, σ_{SED}^2, and σ_{LEL}^2, respectively.

Random intercept vectors were assumed to follow a multivariate normal distribution specified as:

$$\begin{bmatrix} u_0^{CD} \\ u_0^{SED} \\ u_0^{LEL} \end{bmatrix} MVN(0, \Sigma_u) \qquad \Sigma_u = \begin{pmatrix} \tau_{CD} & 0 & 0 \\ 0 & \tau_{SED} & 0 \\ 0 & 0 & \tau_{LEL} \end{pmatrix} \Omega_u \begin{pmatrix} \tau_{CD} & 0 & 0 \\ 0 & \tau_{SED} & 0 \\ 0 & 0 & \tau_{LEL} \end{pmatrix}$$

where τ_{CD}, τ_{SED}, and τ_{LEL} are the random intercept standard deviations and Ω_u is the between-random intercept correlation matrix. This correlation matrix allows us to model classroom-level correlation among random intercepts for the three outcomes.

Initial exploratory analyses revealed non-trivial left-skewness in model residuals if a Normal distribution was assumed. To help account for this skewness, we assumed the residuals follow a Skew-Normal distribution (e.g., Azzalini & Capitanio, 1999), where the outcome-specific shape parameters, which control the degree of skewness, were modelled by the data.

B.2. Bayesian estimation details

Because analysis took place in a fully Bayesian setting, prior distributions needed to be assigned to all parameters. The between-random-intercept correlation matrix (Ω_u) was assigned the uninformative LKJ(1) prior (Lewandowski, Kurowicka, & Joe, 2009). Random effect standard deviations (τ) and random error standard deviations (σ) were assigned weakly-informative half-t priors, with a scale parameter of 10, which have been shown to perform well in multilevel models (e.g., Gelman, 2006). Finally, the population-level regression coefficients (β) were assigned uninformative flat priors.

For each model estimated, we used three parallel MCMC chains with random starting points, which ran for 3,000 iterations following a burn-in period of 2,000 iterations. Chains were thinned such that every 5th sample was recorded to ensure the samples were virtually independent. Sampling parameters were chosen such that the number of effective samples per parameter was greater than 1,000. Convergence was established by a visual examination of the MCMC chains and by ensuring that the potential scale reduction factor (PSRF) statistics were at most 1.00 for all parameters.

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