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Abstract

This study focused on the relationship between socio-economic status (SES) and early attainment and considered the roles of preschool attendance and executive function (EF) in this association. Participants were 3,331 children (1,584 girls), ranging in age from 36 to 71 months from Cambodia, Mongolia, and Vanuatu. Children's language, literacy and mathematics attainment and EF were assessed using the East Asia-Pacific Early Child Development Scales (EAP-ECDS). Mothers provided demographic information and reported on their children's preschool experience in individual sessions. Results indicated that in all three countries there were significant relationships between SES and academic attainment. Mediation analyses further indicated that preschool attendance and EF were significant mediators in SES-related disparities in attainment but their effects varied by country. Preschool attendance was a significant mediator of SES-related disparities in literacy in Cambodia; EF mediated the associations between SES and children's mathematics and language performance in Vanuatu; and preschool attendance and EF served as both parallel and sequential mediators in the associations between SES and performance in language, literacy and mathematics in Mongolia. Our findings indicate that although SES has a substantial influence on early academic outcomes in these developing countries, preschool attendance and EF may attenuate this relationship. Implications for provision of early childhood education programmes and public policy are discussed.

Keywords: preschool attendance; executive function; socio-economic status; early achievement; East Asia- Pacific Early Child Development Scales (EAP-ECDS)

Preschool Attendance and Executive Function Mediate Early Academic Achievement Gaps in East Asia and the Pacific

Socio-economic status (SES)–related early academic achievement gaps exist in both developed (Pratt, McClelland, Swanson & Lipscomb, 2016; Sektnan, McClelland, Acock & Morrison, 2010; Stumm, 2017) and developing countries (Su et al., 2017). SES gradients in reading, mathematics and school readiness are evident as early as kindergarten entry (Dearden, Sibieta & Sylva, 2011). Children from wealthier families who typically have more educated parents tend to show better achievement in language (Hindman, Wasik & Snell, 2016), literacy (Chung, Liu, McBride, Wong & Lo, 2017) and mathematics (Cadima, Gameles, McClelland & Peixoto, 2015) compared to their counterparts from less privileged families. Although the relationship between SES and early academic achievement has been well-documented, the mechanisms that account for this association have not been explored thoroughly, particularly in developing countries. Against this background, this study considered whether and how disparities in SES are related to early academic achievement in these countries. Studies have shown that several factors can influence the relationship between SES and early academic achievement. The present study examined two of these key factors: preschool attendance and executive function.

Preschool Attendance. Participation in quality early childhood education (ECE) programmes has been linked to better school readiness and the narrowing of SES-related achievement gaps particularly for children from low-SES backgrounds (Ludwing & Sawhill, 2007). In the United States, for instance, evaluations of the Abecedarian (Campbell, Ramey, Pungello, Sparling & Miller-Johnson, 2002), Perry Preschool (Heckman et al., 2010) and Chicago Child-Parent Center (Reynolds, Temple & Ou, 2010) programmes that are offered universally to children from low-income or ethnic minority families have shown long-lasting

effects and large benefits for participants (Bartik, 2011), whilst Head Start and Early Head Start programmes have had mixed findings (Love et al., 2005; Puma, Bell, Cook & Heid, 2010). In most developing countries, gross enrolment rates in pre-primary education have been increasing but remain relatively low. For example, the gross enrolment rate for pre-primary education in developing countries in 2014 was 39% (UNESCO, 2016) and the quality of the early childhood education programmes varied greatly (Myers, 2006; Rao & Sun, 2015). Therefore, it might be highly challenging for children from low-SES families to catch up with their more advantaged peers in developing countries. Attending an ECE programme could be particularly effective in such contexts. Rao et al. (2012a) compared the school readiness of children with different types of preschool experiences in Cambodia and found that children who participated in some form of ECE performed significantly better than those who had no preschool experience before entering primary school. Similarly, Rao et al. (2012b) examined the early academic achievement of children with different preschool experience in rural China and found that those with developmentally appropriate kindergarten program showed higher mathematics and literacy achievement at the end of Grade 1 than children who merely "sat in" Grade 1 classes or had no preschool experience. These findings suggest that some developmentally appropriate preschool experience is better than none for enhancing children's early development and learning in a developing country despite variations in programme quality.

Executive function (EF). Skills underlying EF lay the foundation for school readiness and early academic outcomes (McClelland, Leve & Pears, 2016). Of great concern are findings from studies showing that children who grow up with family risks such as poverty and ethnic minority status tend to have difficulties with EF and continue to lag behind their peers after they start school (Evans & Rosenbaum, 2008; Sektnan, McClelland, Acock & Morrison, 2010). Preschool provides opportunities to children to learn how to manage their thoughts, behaviour and

emotions appropriately, follow instructions correctly, and shift their attention according to task demands. Hence it is reasonable to hypothesise that preschool participation supports the development of young children's EF skills and that EF skills may be one reason that children with preschool experience show better achievement in primary schools than their peers without such experience.

Although prior studies have documented the potential importance of both preschool attendance and EF in relation to SES-related early academic outcome gaps, it is still unclear whether preschool attendance and EF serve as viable mechanisms that help transfer the benefits of high SES to children's early academic achievement in developing countries. Using validation data from the East Asia-Pacific Early Child Development scales (EAP-ECDS), this study extends prior studies and examines the possible parallel and sequential mediating roles of preschool attendance and EF on SES-related disparities in early academic outcomes in Cambodia, Mongolia, and Vanuatu.

SES-related early achievement gaps and preschool attendance

The accumulated evidence on the prevalence of SES-related gaps in early academic achievement shows that early childhood experiences are particularly important for children from disadvantaged families (Bradbury, Corak, Waldfogel & Washbrook, 2015). As a result, in recent decades great policy interest in children's early life experiences has been seen across countries through investment in the expansion of public preschools and the enhancement of parenting skills in both developed (Bassok, Finch, Lee, Reardon & Waldfogel, 2016) and developing countries (Richter et al., 2017).

High-SES families usually provide more resources to support young children's learning and development, accounting for the superior academic performance of children from high-SES families than other children (Chung, 2015). Preschool education is one essential and effective,

but costly investment for these families. Studies from both developed and developing countries have shown the positive short-term impact of preschool programmes on children's academic school readiness and children make larger gains in preschool programmes with higher quality (Yoshikawa et al., 2013). Furthermore, children from economically disadvantaged backgrounds are likely to benefit at least as much as their more advantaged peers from participation in preschool programmes (Britto, et al., 2017; Wong, Harrison, Rivalland & Whiteford, 2014). Ip et al. (2016) examined the possible mechanisms that underlie the early SES gradients detected in Hong Kong and found that teacher qualification and kindergarten facilities, two major proxies for the quality of preschools, were significant mediators of SES gradients.

Disparities in enrolment in preschool programmes are, however, evident among children from disadvantaged backgrounds (Huston & Bentley, 2010). Using longitudinal data from the annual 'current population survey' from 1968 to 2013, Magnuson and Waldfogel (2016) examined the trends in income-related enrolment gaps in centred-based early childhood education for 3- and 4-year-old children in the United States. They found growing income-related gaps in early education enrolment between children from the lowest and the highest income quintiles in the 1970s and 1980s, followed by a stable gap for 3-year-olds and a declining gap for 4-year-olds thereafter. The pattern detected in income-related enrolment gaps was in line with recent trends in income-related gaps in school achievement, as noted by Reardon (2011). Using the Early Childhood Longitudinal Study – Kindergarten Class (ECLS-K) of 1998-1999 (ECLS-K: 98) and the ECLS-K 2010-2011 (ECLS-K: 10), Bassok et al. (2016) examined socioeconomic gaps in early childhood experiences, including child care arrangements. They found that socioeconomic gaps in preschool participation grew from 1998 to 2010, despite increased government investment in public preschools. O'Connor et al. (2016) reported that children from non-English speaking and indigenous backgrounds and disadvantaged

communities from both cohorts were less likely to be enrolled in preschool than the total population using data from the Australian Early Development Census (AEDC) in two sequential population cohorts of 2008 and 2011. Few studies have investigated the association between SES and preschool attendance in developing countries, but the limited existing studies suggest a similar association as detected in the developed countries. For example, Gong, Xu, and Han (2015) found a positive association between household income per capita and preschool attendance in both the rural and urban settings in China. Nevertheless, it is known that due to limited public investment in ECE, children from low-SES families may encounter more barriers to preschool enrolment than their counterparts in developed countries. A study by Delprato, Dunne and Zeitlyn (2016) systematically investigated how factors at the individual, community and country levels influenced preschool attendance in 21 developing countries, and found that SES and health factors were the most important barriers to attendance. The study also found that household wealth had a stronger impact than individual demographic factors. Specifically, children's demographic and SES characteristics explained 23% of the variation between countries, suggesting that the composition of the children's SES characteristics (including parents' education, family wealth and maternal occupation) mattered for inter-country differences in preschool attendance.

Using data from the Young Lives project in Peru, Ethiopia, India and Vietnam, Boo (2016) and Woldehanna (2016) examined the relationship between SES and child development. Using the Peabody Picture Vocabulary Test (PPVT), Boo (2016) examined the performance of young children from high- and low-SES families in the four developing countries - Peru, Ethiopia, India and Vietnam - and found that urban residence, caregiver education and early nutrition were significant mediators of the SES-PPVT relationship in all of them and for most ages. However, preschool attendance was a minor mediator in Ethiopia and Vietnam at five years of age. It

should be noted that the PPVT has not been validated as a valid indicator of children's receptive language in the four above-mentioned developing countries. Similarly, Woldehanna (2016) explored factors related to preschool access and their effects on cognitive development at 5 and 8 years of age using longitudinal data from Ethiopia. In a country with only around a quarter of preschool-aged children having the opportunity to attend preschool, significant differences in preschool attendance based on family wealth, education and regional location were detected. Preschool attendance was further found to mediate one third of the direct effects of family wealth, education and regional location on children's cognitive development.

Research has shown that children from high-SES families tend to have more opportunities to attend ECE programmes and have better early academic skills than their less privileged peers. The importance of attending preschool to narrow early SES-related achievement gaps has also been highlighted, based on evidence demonstrating the effectiveness of preschool programmes. However, there is still a lack of empirical evidence to illustrate whether or to what extent preschool attendance works to narrow early SES-related achievement gaps, especially in developing countries where fewer public resources are available to support children's enrolment in such programmes.

SES-related early achievement gaps and EF

EF in young children is an ill-defined construct and is generally described as an umbrella term of top-down mental processes that support children's ability to regulate their behaviour in goal-directed problem solving settings over time (Griffin et al., 2016). Researchers have generally characterised EF as having three basic components: (a) working memory (the ability to retain information in the mind and manipulate it in appropriate ways); (b) inhibitory control (the ability to deliberately suppress attention and responses to some stimuli in order to solve problems correctly); and (c) cognitive flexibility (the ability to think about tasks in multiple ways and not

rigidly stick to one aspect). Given that EF has been studied in multiple disciplines, other terms (e.g., self-regulation, behavioural regulation and effortful control) have emerged to refer to skills that are similar to EF (McClelland, Leve & Pears, 2016). In this study we use the term EF to refer to a composite of working memory, inhibitory control and attentional/cognitive flexibility.

Children's EF emerges during early childhood and improves greatly over the preschool years (Wiebe, Sheffield & Espy, 2012). It is crucial for young children to acquire EF skills because these skills have been consistently found to predict school readiness and academic success. For example, children's EF is related to early literacy skills (Becker, Miao, Duncan & McClelland, 2014; Lonigan, Allan & Phillips, 2017), language development (Becker, Miao, Duncan & McClelland, 2014; Clark, Pritchard & Woodward, 2010), mathematics achievement (Becker, Miao, Duncan & McClelland, 2014; Weiland, Barata & Yoshikawa, 2014), school readiness (Vitiello, Greenfield, Munis & George, 2011), and later academic achievement (Blair & Diamond, 2008; Hubert, Guimard, Florin & Tracy, 2015).

The links among EF and early learning and academic achievement may be of special importance for children from low-SES families because they have been found to be less competent in EF skills compared to their more affluent peers (Evans & Rosenbaum, 2008; Hackman, Gallop, Evans & Farah, 2015). Evans and Kim (2013) reviewed the possible mechanism through which childhood poverty affects children's self-regulation, including parental investment, parenting practices and chronic stress and coping. Parents in high-SES families are more likely to provide cognitively enriched activities and resources (Bradley & Corwyn, 2002), to talk more to their children (Hart & Risley, 2003), and to be more sensitive to their children's needs (Sun & Rao, 2012). In contrast, children from low-SES households are more likely to grow up in less-functional families with more family conflict and turmoil, family dissolution, maternal depression and exposure to violence, thereby elevating chronic stress

(Evans & Kim, 2013). More broadly, McClelland et al. (2016) suggested four areas of family risk that could impede the development of EF: (a) contextual risk, (b) parenting factors, (c) prenatal influences, and (d) genetic influences.

As EF is associated with both SES and academic achievement, it has been tested as an important mediator of SES-related achievement gaps (Lawson, Hook, Hackman & Farah, 2016). In two studies, one with a rural Caucasian sample and the other with an ethnically diverse national sample, Evans and Rosenbaum (2008) found a significant path of family income → self-regulation → achievement. These findings indicate that EF as measured by a delayed gratification task, mediates SES-related early achievement gaps. Sektnan et al. (2010) found modest indirect effects of behavioural regulation, measured by parent- and teacher-rated behavioural regulation scales, in the association between ethnicity, maternal education, maternal depressive symptoms and first-grade achievement in reading, mathematics and vocabulary. Using longitudinal data from the National Institute of Child Health and Human Development study of early child care, Crook and Evans (2013) further found that children's ability to plan, as measured by the 'tower of Hanoi' task in Grade 3, mediated income-achievement gaps in mathematics and reading. Measuring behavioural regulation through the Head-Toes-Knees-Shoulders direct assessment task, Cadima et al. (2015) found that children's behavioural regulation mediated the association between family risk (indexed by maternal education, family income and maternal job status) and children's mathematics achievement in Portugal. Similarly, Lawson and Farah (2017) found that EF partially mediated the relationship between SES and change in children's mathematics achievement. The mediating role of EF has also been detected in studies in which EF was assessed by a set of tasks that measure its various sub-components, including working memory, inhibitory control and cognitive flexibility (Fitzpatrick, McKinnon, Blair & Willoughby, 2014; Nesbitt, Baker-Ward & Willoughby, 2013).

The accumulated evidence suggests the potential importance of EF for narrowing or eliminating SES-related gaps in academic achievement. However, questions still remain as to how SES contributes to children's EF. According to McClelland et al. (2016), contextual risks are key factors that impede the development of EF for children from low SES families. Children from low-SES families in developing countries are unlikely to attend ECE programmes. This lack of preschool experience may be considered a critical contextual risk factor for these children as preschool attendance facilitates the development of EF. Hence, preschool attendance and EF are both promising mediators on the path from SES to early academic achievement and they may mediate the SES-related gap sequentially. In this study, we aim to further explore the multiple mediation effects of preschool attendance and EF on the SES-related early achievement gaps in three developing countries in East Asia and the Pacific.

Preschool attendance and EF

Family and school are the two major venues in which children are socialised and learn interpersonal skills that help them behave appropriately and acquire the requisite skills to conform to society's values. Family is the first and most influential context for the development of young children, whereas the influences of school become more significant as children mature. When they enter preschool, children often experience challenges adjusting to the learning and social environment. In the classroom, children are expected to listen carefully, obey the teachers' instructions and focus on the task at hand. They are also expected to get along with their classmates and control their impulses in group learning situations.

Although countries set different goals for ECE, EF-related skills and capacities (such as appropriate behaviour, emotional regulation, goal-directed problem solving, pleasure and engagement in learning) have been either explicitly emphasised or implicitly embedded within the educational goals of different learning domains. These have included cognitive, socio-

emotional, linguistic and physical development, which are crucial to children's preparedness for formal schooling (Feyter & Winsler, 2009). Preschool education encourages and supports the early development of EF. In particular, children are expected to systematically learn EF-related skills through multiple learning activities, especially when they are introduced to the rules and routines of formal schooling and learning cooperatively with their classmates. Zhang (2012) examined the relationship between the preschool experience and children's EF in rural China and found that preschool contributed to the early development of EF. Children who attended some type of early childhood education programme in rural China, such as kindergarten, pre-primary classes or sitting-in on Grade 1 classes before primary school, showed significantly better self-regulation skills by the time they reached Grade 1 than those who had no preschool experience. There are also intervention studies showing that programmes supporting children's self-regulation, such as Tools of the Mind (Diamond, Barnett, Thomas, & Munro, 2007), PATHS (Promoting Alternative Thinking Strategies) the Kids in Transition to School Program (Pears, Fisher, Bruce, Kim, & Yoerger, 2010), the Chicago School Readiness Project (Raver et al., 2011) and Preschool RULER (Rivers, Tominey, O'bryon, & Brackett, 2013), facilitate children's early learning.

Studies have illustrated how preschool supports the early development of EF. For example, introducing children to multiple play-based learning activities in preschool together with engaging in play, especially socio-dramatic play, is fundamental to the development of EF. When children undertake such play activities, they must implement goal-directed behaviour, cooperate with peers, focus attention on the task and control their personal impulses (Elias & Berk, 2002; Timmons, Pelletier & Corter, 2016). The quality of teacher-child interaction is also important for enhancing children's EF skills. Teacher-child closeness has been found to predict improvement in children's self-regulation skills and higher instructional quality has brought

more benefit to children with low self-regulation skills than to other children (Cadima, Verschueren, Leal & Guedes, 2015). However, the time that a teacher spends on class-wide classroom behavioural socialisation rather than individual dyadic interactions has been found to negatively predict children's self-regulation skills (Degol & Bachman, 2015). Zhang (2012) found that in rural China, the kindergarten classes that were the most successful at facilitating children's self-regulation were those in which teachers adopted more strategies to help students become engaged, for example, by asking more open-ended questions, providing a variety of age-appropriate learning activities and using clear instructions.

The present study

Previous studies have shown SES-related differences in early academic achievement in both developed and developing countries. Preschool attendance and EF have also been proposed as promising mediators that account for the association between SES and early academic achievement. In additional, preschool experience has been found to benefit the development of EF. It is therefore likely that preschool experience and EF might work together to contribute children's early academic achievement. To date, however, few empirical data have been available to elucidate the specific mechanism explaining whether or how preschool attendance and EF work together on the path from SES to early academic achievement. Using validation data from the East Asia Pacific Early Childhood Development Scales (EAP-ECDS), we explored whether preschool attendance and EF sequentially or independently mediated the established SES-related early academic achievement gaps in Cambodia, Mongolia, and Vanuatu.

This study was unique in that we examined the multiple mediating effects of preschool attendance and EF in SES-related early academic gaps by examining their independent and sequential mediating effects at the same time. The models were tested in three East Asia–Pacific developing countries. This allowed further exploration of the similarities and differences of the

mediating effects of preschool attendance and EF in countries that differ in societal and economic development in addition to the provision and quality of early childhood education.

There were three research questions in this study: (a) whether there were SES-related differences in early language, literacy and mathematics development in Cambodia, Mongolia and Vanuatu; (b) whether preschool attendance and EF serve as parallel mediators in the associations between SES and children's academic achievement in language, literacy and mathematics across the three countries; and (c) whether preschool attendance and EF sequentially mediate SES-related differences in early achievement in mathematics, language and literacy in each of the three countries. We hypothesised that SES would significantly predict children's early academic performance in language, literacy and mathematics in the three countries, and that preschool attendance and EF would serve as both independent and sequential mediators in the associations between SES and children's performance in the domains examined.

Method

Participants

The participants in this study were drawn from the validation sample of the EAP-ECDS with data collected between 2013 and 2014 from a population-based sample of 8,439 children of 36 to 71 months of age from six countries: Cambodia, China, Mongolia, Papua New Guinea, Timor-Leste and Vanuatu. As all of the children in the China sample attended preschool, and the preschool participation rate of Papua New Guinea and Timor-Leste were as low as 2.9% and 6.4%, respectively, we omitted data from the China, Papua New Guinea and Timor-Leste in this study. The subsample for the current analysis included children from Cambodia, Mongolia and Vanuatu, with a total of 3,331 children (1,584 girls) 36 to 71 months of age stratified by age, gender and urban/rural residence. Most children recruited were from two-parent families, while we did not have information indicating whether they were from single-parent or two-parent

families. Complete data on items and the information on child age, gender, urban/rural residence and preschool attendance are available. Table 1 summarises the characteristics of the sample.

Country context

Details on the validation sample's country context can also be found in the project's technical report (Rao et al., 2014). In general, there were vast variations in country contexts among the three countries. For example, the populations of Cambodia, Mongolia, and Vanuatu were 15.2 million, 2.8 million and 0.26 million, respectively. The 2012 gross domestic product per capita, adjusted for purchasing power parity (PPP) in the three countries was US$2,400 in Cambodia, US$5,400 in Mongolia and US$4,531 in Vanuatu (Rao et al., 2014). The governments of all three countries have taken some responsibility by supporting the development of ECE; however, the level of development differed. The gross enrolment ratio for pre-primary education in 2014 was 18% in Cambodia, 86% in Mongolia and 97% in Vanuatu (UNESCO, 2016). In recent years, the governments of the three countries have adopted or launched different policies to promote ECE. In 2010, Cambodia's Royal Government launched plans to expand children's access to preschool, especially in the remote areas (Royal Government of Cambodia, 2010). The Mongolia education master plan for 2006-2015 put forward a series of initiatives to improve the quality of early childhood education, including building new schools and providing adequate teacher training (Government of Mongolia, 2006). In 2009, Vanuatu's Ministry of Education promulgated the Vanuatu education road map, suggesting that the country should improve the quality of teachers and facilities and implement a standards framework for its national kindergarten curriculum (Ministry of Education, Government of Vanuatu, 2010).

Measures

All items related to early child development were from the EAP-ECDS, an 85-item regionally-based scale designed to assess the holistic development in seven domains (Cognitive

Development; Language & Emergent Literacy; Socio-Emotional Development; Motor Development; Cultural Knowledge and Participation; Health, Hygiene and Safety; and Approaches to Learning). The EAP-ECDS are a psychometrically robust and culturally appropriate measurement tool for the region (αs for the seven domains ranged from .74 to .95). They are untimed and take about 45 to 60 minutes to administer. All items were presented in a fixed order in the local language by trained assessors following a standardized assessment procedure. The inter-assessor reliability was checked approximately every 20 test administrations to ensure that the agreement rate with the gold standard in the country was at least 85%. More details on sample distribution, data collection, exclusion and enrolment criteria and psychometric information from the EAP-ECDS can be found in the technical report on the scale's validation study (Rao et al., 2014).

Early academic achievement. There are 21 items in the Cognitive Development domain of the EAP-ECDS which capture children's understanding of basic concepts, memory skills, inhibitory control skills, and arithmetic knowledge. We selected 12 items related to early mathematics learning therefrom and these items cover the major areas of early mathematics learning including numbers, arithmetic, shapes, patterns and time to assess children's early mathematics performance (α = .92 in the three countries).

The Language & Emergent Literacy domain of the EAP-ECDS contains 16 items and two of them evaluate children's expressive language and whether the assessor understands children's language during the assessment process. We excluded these two items and used the remaining 14 items which assess competence in oral language (eight items, α = .90, .80 and .92 in Cambodia, Mongolia and Vanuatu, respectively) and literacy (six items, α = .93, .90 and .93 in Cambodia, Mongolia and Vanuatu, respectively). Items in the oral language measure assessed children's

expressive and receptive language abilities and items in the literacy measure examined children's early writing and reading skills.

The total scores for the three measures were calculated, and country-adjusted z-scores for the three measures were used in the following analyses. This approach was also adopted in studies using the EAP-ECDS data (Weber, Darmstadt, & Rao, 2017). Because the EAP-ECDS were based on the early learning and development standards of countries in East Asia and the Pacific region (Rao et al., 2014), these items were believed to reflect those countries' expectations for child learning in different domains during their early years.

Socio-economic status (SES). SES is usually measured using variables including parental education, occupation, income (or wealth), and home possessions (Harwell, 2018). We therefore used information related to family assets, together with parent education and occupation to create a SES index. Specifically, primary caregivers (usually mothers) were asked whether the family owned 12 types of basic household appliances and commonly used material items (e.g., radio, television, refrigerator, watch, car). A family asset score was calculated by summing up the scores from the 12 questions as was conducted in Weber et al. (2017). Information on maternal and paternal education (from no formal education to postgraduate) and occupation (from no employment to professionals) was also collected during the interviews. We used the highest level of education achieved by the most educated parent to represent parental education level, whereas information on both maternal and paternal occupations was included to generate the SES index. The cases in which no parental education or occupation information was available were treated as missing in the parental education (2% in Cambodia, 0% in Mongolia, and 4.4% in Vanuatu) or occupation (maternal occupation: 2.3% in Cambodia, 0.2% in Mongolia, and 4.2% in Vanuatu; paternal occupation: 2.3% in Cambodia, 5.4% in Mongolia, and 10.4% in Vanuatu) proxy. There

were no significant differences detected in terms of children's performance between those with complete parental education or occupation information and those without it.

A principal component analysis was further used to generate the SES index using the highest educational level attained by the most educated parent, maternal and paternal occupations and family assets as variables. Separate analyses were conducted for each country with the first component scores referring to SES. These composite SES index scores captured 51.11% of the total variance in Cambodia, 50.51% in Mongolia and 44.86% in Vanuatu.

Executive Function (EF). Five items from the Cognitive Development domain of the EAP-ECDS, (sentence repetition, multiple-step instructions, pencil tapping, flexible card sorting and the basic version of the dimensional change card sorting), formed the measure of EF (α = .81, .88 and .88 in Cambodia, Mongolia and Vanuatu, respectively). Sentence repetition and multiple-step instruction assessed children's working memory. In the sentence repetition task, children were asked to exactly repeat the sentences they heard, and if they repeated a sentence correctly they would be asked to repeat a longer sentence. The children received one credit if they accurately repeated the assessor's sentences in a total of three trials, with an increasing number of words (from five to seven words). In the multiple-step instruction task, the assessor instructed children to perform three consecutive actions. One credit would be earned if the child correctly followed and performed one particular step in the instruction. In the pencil tapping task, the children were asked to tap once if the assessor tapped twice and vice versa for a total of six trials. The children could acquire one credit if they tapped correctly. The flexible card sorting task assessed the children's competence at sorting a group of cards according to three dimensions of size (big, middle and small), colour (red, green and blue) and shape (circles, squares and triangles). The basic version of the dimensional change card sorting task asked children to first sort a group of cards consisting of red/blue rabbits and boats according to colour (Phase I) then

shape (Phase II) upon being given instructions, without any pause in between. Each phase included six trials. One credit was given if the child successfully sorted all six cards in one phase. The total score (maximum score = 18) for the five above-mentioned tasks was calculated and country-adjusted z-scores were used for further analyses.

Control variables. Information on the children's age, gender and urban/rural residence was also obtained during the parent interview. Table 1 reports the descriptive statistics for these control variables across each country.

Analytical Plan

A series of regression analyses were performed in Mplus 7.0 to test the possible mediating effects of preschool attendance and EF in associations between SES and early achievement in language, literacy and mathematics separately using the EAP-ECDS validation data from Cambodia, Mongolia and Vanuatu. Due to the contrasting societal and economic contexts among countries, we considered it inappropriate to combine the data from three countries and separate analyses were conducted for each country. The sample size of each country meant that there was adequate statistical power for country-specific analyses.

Based on Baron and Kenny (1986), we adopted several steps to test the parallel and sequential mediating effects of preschool attendance and EF in SES-related early achievement gaps. The first regression examined the predictive effects of SES on early achievement to address the first research question. To address the second research question, we conducted another three regressions: one to show whether SES predicted both preschool attendance and EF, one to test whether both mediators predicted children's early achievement, and one to treat the mediators as parallel or independent on the path from SES to early achievement. To address the third research question, we first tested whether preschool attendance predicted EF and then examined the sequential mediating effects of preschool attendance on children's EF (SES →

preschool attendance → EF → achievement). We further tested the last model which treated preschool attendance and EF as the parallel (SES → preschool attendance → achievement; SES → EF → achievement) and sequential mediators (SES → preschool attendance → EF → achievement) simultaneously in the association between SES and early achievement in mathematics, language and literacy.

Multivariate multiple regressions were used for the analyses of each country model. The model's fitness was examined using the index of weighted root mean square residual (WRMR) for preschool attendance, which was a categorical variable treated as a mediator. According to Yu and Muthén (2002), a model with a WRMR less than 1.0 indicates a good fit. In the models that only included continuous variables as outcome variables, a model was accepted if the comparative fit index (CFI) was not lower than 0.96, the root mean square error of approximation (RMSEA) was 0.06 or less and the standardised root mean square residual (SRMR) was 0.09 or less (Hooper, Coughlan & Mullen, 2008). In all analyses, the missing data (4.59% in Cambodia, 6.10% from Mongolia, and 13.22% from Vanuatu; all from the SES index) were handled using full information maximum likelihood, and sensitivity analysis was conducted using the bootstrap estimation (bootstrap = 1000) of standard errors.

Results

The descriptive statistics of key variables are presented in Table 1. Bivariate correlations between the variables of interest and demographic variables for each country are presented in Table 2. Child age and urban/rural residence were significantly correlated with child outcome variables in all three countries, and child gender was significantly correlated with child achievement in Mongolia and Vanuatu. Hence, in the analyses for Mongolia and Vanuatu, child age, gender and urban/rural residence were treated as control variables, whereas in the analyses for Cambodia, the control variables consisted of child age and urban/rural residence. Following

Baron and Kenny (1986), we adopted several regression models in examining the direct predictive effects from: (a) SES to preschool attendance, SES to EF and preschool attendance to EF; (b) from SES to early language, literacy and mathematics achievement; and (c) from preschool attendance and EF to early child achievement, controlling for age, gender and urban/rural residence in each country's dataset.

All of the above-mentioned direct effects were significant for the Mongolian dataset. In contrast, SES only significantly predicted children's literacy performance and was not associated with EF even though preschool attendance was associated with children's language, literacy and mathematics performance in Cambodia. In Vanuatu, SES was positively associated with language performance but negatively associated with mathematics performance, and it was not associated with children's preschool attendance (see Table 3). Therefore, we further tested (a) the mediating effects of both preschool attendance and EF in the relationship between SES and children's performance in language, literacy and mathematics in Mongolia; (b) the mediating effects of preschool attendance in the relationship between SES and children's literacy performance in Cambodia; and (c) the mediating effects of EF in the pathway from SES to children's language performance in Vanuatu. For the association between SES and children's mathematics performance in Vanuatu, we considered whether EF also played a significant role, given the positive correlations between SES and EF and between EF and mathematics performance. Therefore, we also tested the mediating role of EF in the SES-related mathematics gap in Vanuatu, even though it favoured low-SES children.

In the analyses of mediating models for Mongolia, we examined (a) the parallel mediating effects only, (b) the sequential mediating effects only, and (c) both the parallel and sequential mediating effects of preschool attendance. EF showed satisfactory model fit, and the last model had the lowest WRMR, indicating the best fit ($WRMR_{parallel\ only} = .782$, $WRMR_{sequential\ only} = .779$,

$WRMR_{parrallel + sequential}$ = .001). The models for single mediator analysis for Cambodia and Vanuatu also achieved acceptable model fit (for the Cambodian model: $WRMR_{Cambodia}$ = .861; for the Vanuatu model: χ^2 (26, N = 770) = 1811.95, p < .001, CFI = .99, RMSEA = .08, SRMR = .01).

The coefficients of the path analysis models for each country dataset are shown in Figure 1. In Mongolia, the path of SES → preschool attendance → EF → early achievement was significant for child achievement in language (indirect effect = 0.02, p <.001, mediation proportion = 11.8%), literacy (indirect effect = 0.02, p <.001, mediation proportion = 10.3%) and mathematics (indirect effect = 0.03, p <.001, with mediation proportion = 13.3%). The parallel mediating effects of preschool attendance and EF were also significant for child mathematics (indirect $effect_{Preschool}$ = 0.03, p = .007, mediation proportion = 13.3%; indirect $effect_{EF}$= 0.05, p < .001, mediation proportion = 24.5%), language (indirect $effect_{Preschool}$ = 0.03, p = .008, mediation proportion = 18.8%; indirect $effect_{EF}$= 0.04, p < .001, mediation proportion = 21.2%) and literacy achievement (indirect $effect_{Preschool}$ = 0.04, p < .001, mediation proportion = 19.0%; indirect $effect_{EF}$= 0.04, p < .001, mediation proportion = 19.0%). In Cambodia, the path of SES → preschool attendance → literacy achievement was significant (indirect effects = 0.05, p < .001, mediation proportion = 28.6%). After EF was added to the model, SES was no longer associated with children's language achievement, indicating the full mediation effect of EF in Vanuatu. At the time, the standardised coefficient of SES to mathematics changed from −.09 to −.14 and the indirect effects from SES to child mathematics achievement through EF were significant (indirect effect = 0.05, p = .034), indicating that the path of SES → EF → early mathematics achievement was also viable in Vanuatu.

Discussion

This study examined the relationship between SES and early attainment and considered the roles of preschool attendance and EF in this association. Significant SES-related differences in early academic achievement were found in all three countries. In Cambodia, children from high SES families tended to have higher literacy scores, whereas SES was significantly positively associated with Mongolian children's performance in language, literacy and mathematics. In Vanuatu, SES also significantly positively predicted children's language performance. These findings add to the existing literature on SES-related disparities in early achievement in developing countries. We therefore further explored the possible mechanisms accounting for such association.

Contrary to predictions, SES was negatively associated with children's early mathematics performance in Vanuatu. The mathematics performance of these children might be related to child-rearing practices. In Vanuatu, child-care has traditionally been viewed as a shared responsibility, and the extended family has remained the dominant social structure, especially in rural areas where more families have suffered from poverty than in the cities. Growing up in extended families, rural low-SES children have formed kinship and community connections and are expected to help with domestic chores at a young age (UNICEF, 2016). Such daily engagement in a subsistence-exchange economy may have provided children with opportunities to understand the characteristics of objects as they have related to quantity, position, time and shape. This could be helpful to their early mathematics development. The phenomenon might also be similar to the mathematics development of Brazilian child street vendors, whose everyday cultural practices support the construction of mathematics knowledge (Saxe, 1988).

In contrast, the benefits of extended families have gradually been fading in urban areas due to the rapid modernisation of the Pacific, where the society has been transforming from a

subsistence-exchange to a cash economy (Kick, 2001). This has been true for Vanuatu (UNICEF, 2016). Urban families, especially those that have enjoyed the societal and economic transformation and have high SES, have been transitioning from extended to nuclear families. Parents have been assuming more responsibility in caring for their young children, and the role of extended families has weakened (Kick, 2001). In such circumstances, the high-SES children in this study, who were less connected with their extended families than their low-SES peers, might have had fewer opportunities to become engaged in the daily subsistence exchange activities and other household chores found in large families. As a result, they might have demonstrated a lower level of mathematics skills than those from low-SES families.

It was also surprising that SES-related gaps in early academic achievement were not significant in the mathematics and language performance of Cambodian children or the literacy performance of Vanuatu children. These findings might be related to the level of national societal and economic development. Among the three countries, Vanuatu had the highest Gini index (37.19 in 2010) (World Bank, 2010a), whereas Mongolia had the highest HDI index (0.735 in 2014) (United Nations, 2014). However, this study's findings contradict the findings of Chmielewski and Reardon (2016) on the association between income and academic achievement in developed countries. They used data from the Progress in International Reading Literacy Study (PIRLS) and the Programme for International Student Assessment (PISA) and found that national levels of poverty and inequality were positively associated with income achievement gaps. Therefore, the formation mechanism of early academic achievement gaps in developing countries might differ somewhat from those of developed countries. More studies are needed to better understand the mechanisms that contribute to SES-related early academic achievement gaps in developing countries.

Preschool attendance as an independent mediator

Preschool attendance was found to mediate the relationship between SES and early literacy achievement in Cambodia and between SES and early language, literacy and mathematics achievement in Mongolia. In Vanuatu, although preschool attendance significantly predicted children's mathematics and literacy performance, no differences in preschool attendance were found between children from high-SES and low-SES families.

The contrasting findings from these countries, on the one hand, reflect the development of ECE in the different country contexts. Mongolia is the least densely populated country in the world, which means service delivery has been very costly and education inequality between urban and rural areas has manifested in school access, completion rates and learning outcomes. This has also been true for ECE (World Bank, 2015). In 2012, 24% of children aged 2 to 5 years did not have access to school and the majority were from disadvantaged communities (World Bank, 2015). In recent years, the Mongolian government has exerted great effort to enhance ECE and progress has been made (Rao et al., 2014). Conversely, education reform in Cambodia began in 1990, and enrolment in early childhood education jumped from 6.5% during the 2000-2001 school year to 33% in the 2012-2013 school year. Unfortunately, the participation rate has been lower for children in remote areas, indigenous children, children from poor families and children with disabilities than for their counterparts (Royal Government of Cambodia, 2015). Similarly, Vanuatu only launched its early childhood care and education policy in 2011, aiming to provide access, sound management and appropriate standards for the country. According to the Multiple Indicator Cluster Survey (MICS) 2007 (Royal Government of Cambodia, 2015), no urban/rural differences in preschool attendance in Vanuatu have been found and there have been relatively small differences in preschool attendance between different groups. Some differences have been found between the children from the richest and poorest families, however, no differences have

been found between the middle-income and high-income groups (World Bank, 2012). Our findings further illustrate inequity in ECE participation in these three countries and suggest that further efforts should be made to enhance access to early childhood education for all children, especially those with low SES.

The findings from this study, however, are also in keeping with those that demonstrate the positive relationship between preschool attendance and child development. In all of the countries studied, preschool attendance significantly predicted children's early mathematics and literacy development, indicating that preschool attendance was particularly important for these competencies. Considering the high illiteracy rate (43% in 2010, World Bank, 2010b) and the lack of mathematics proficiency (Nagao, Rogan, Magno, 2007) in developing countries, enhancing preschool enrolment should be integrated with the countries' initiatives to achieve their millennium development goals. Systematic reviews of national ECE curricula should also be conducted to ensure that preschool education enhances children's holistic learning and development.

In the two countries (Cambodia and Mongolia) with SES-related disparities in preschool access, preschool attendance was found to mediate early academic achievement gaps. Although the percentage of mediated effects varied across studies, the findings are in line with recent studies conducted in Ethiopia (Boo, 2016; Woldehanna, 2016), as well in India, Peru and Vietnam (Boo, 2016). These studies clearly demonstrated that attending preschool could be a key factor in helping children from high-SES families obtain a better start at an earlier age than children from low-SES families. At the same time, being 'out-of-preschool' contributed to the lower academic performance of children from low-SES families. Again, these findings provide concrete evidence of the inequality that has resulted in developing countries from not attending ECE. Such disparity has served as a mechanism for SES-related early academic achievement

gaps. Approaches aiming to reduce disparities in preschool attendance have potential to narrow the SES-related early academic achievement gaps in these countries.

EF as an independent mediator

EF was found to predict children's language, literacy and mathematics achievement in all three countries. These findings are consistent with most other studies on EF carried out in developed countries (Blair, McKinnon & Family Life Project Investigators, 2016; Clements, Sarama & Germeroth, 2016; Weiland, Barata & Yoshikawa, 2014) and indicate that EF also lays the foundation for academic learning in developing countries. Therefore, it is strongly recommended that children's EF be facilitated in the early years and that participation in ECE could be a feasible approach, which is discussed in the section below.

EF was also found to be related to SES in Mongolia and Vanuatu but not in Cambodia. Accumulated evidence from developed countries has shown the prevalence of SES-related disparities in EF (Evans & Rosenbaum, 2008; McClelland & Wanless, 2012; Noble et al., 2015). Lawson et al. (2016) have suggested that factors related to low SES, including inadequate nutrition, violence, toxins, less sensitive and responsible parenting, lack of cognitive stimulation at home and lack of quality school experiences might be responsible for the lower level of EF among low-SES children. The results from the Mongolia and Vanuatu data in this study provided further evidence of SES-related disparities in EF in developing countries. However, further studies might be needed to discern whether the absence of SES-related disparities in EF found in Cambodia were due to the measurement of relevant key variables or to the unique cultural or contextual factors of the country. For example, SES was treated as a composite of parental education, occupation and family assets in this study, whereas in different countries, SES might have other distinct meanings. In addition, disparate aspects of SES were likely to play different roles in child development, and it was meaningful to examine the effects of the various social

and economic determinants of SES separately (Duncan & Magnuson, 2012). Meanwhile, we speculate that the unique societal circumstances in Cambodia contributed to the lack of SES-related differences in EF. As a country recovering from war and turmoil, the influence of societal change on cognitive functioning might have been universal and stronger than family influences from the micro level, which might have led to the lack of SES-related differences in EF for Cambodian children.

The results further indicate that EF served as an independent mediator in the family-SES related early academic achievement gaps for language, literacy and mathematics in Mongolia and language performance in Vanuatu. This was in line with prior findings and suggests that EF was a viable mechanism responsible for SES-related early academic achievement gaps (Evans & Rosenbaum, 2008). By contrast, the negative association detected between SES and children's early mathematics achievement, in addition to the positive mediating effects of EF in such associations in Vanuatu, indicates a rather complicated developmental process. Some distinct SES-related factors might have affected early mathematics achievement in a different way from EF, but also showed strong influences on early mathematics development in Vanuatu. Such factors could be child-rearing practices and relevant children's daily activities as discussed above.

Therefore, as proposed by other researchers (e.g., Bierman, Nix, Greenberg, Blair & Domitrovich, 2008; Jacob & Parkinson, 2015), findings from this study also suggest that EF should be targeted in future programmes to support early academic development and to mitigate the impact of family risks on early academic achievement in developing countries. This study's findings also indicate the importance of taking particular cultural, contextual and societal factors into consideration when trying to understand early childhood development and design potential supportive strategies. In countries like Vanuatu, identifying other candidate factors that could

explain the differences in early academic achievement and provide targeted support to different groups of children could be particularly important.

Preschool attendance and EF mediate the SES-related early achievement gaps sequentially

Using the Mongolian data, this study identified the sequentially mediating path of SES → preschool attendance → EF → early academic achievement in addition to the independent mediating roles of preschool attendance and EF in early academic achievement in developing countries. Although preschool attendance and EF were not viewed as sequential mediators, accounting for the early academic achievement gaps in all countries, preschool attendance was consistently found to significantly predict EF and EF significantly predicted early academic achievement across countries. We therefore conducted supplementary analyses and found that the path of preschool attendance → EF → early academic achievement was significant in all countries. These findings not only addressed the importance of preschool attendance and EF in early academic outcomes in developing countries but also manifested the complex and context-specific mechanisms underlying early achievement gaps in multiple developing countries.

Although the quality of ECE has been a concern in developing countries (Engle et al., 2011; Rao & Sun, 2015), the findings from this study provide solid evidence on how preschool attendance might have benefitted young children's learning experience in these locales. Children's preschool involvement with imaginary play activities, adult-guided learning activities, trained routines, classroom rules and interpersonal interactions within the school setting are likely to facilitate children's EF, which in turn support the development of early academic competencies, as previously discovered in studies conducted in developed countries (Bierman et al., 2008; Diamond, 2014; Thierry, Bryant, Nobles & Norris, 2016).

The analysis of the Mongolian data revealed both the independent and sequential mediating roles of preschool attendance and EF in the early academic achievement gaps in

language, literacy and mathematics; whereas in Cambodia and Vanuatu, we found that either preschool attendance or EF accounted for the disparities in early academic outcomes. These findings offer a novel view regarding the mechanism driving early academic achievement gaps. Children's performance differed in terms of learning domains across countries and the cause of the gaps could be traced to different factors that were highly related to particular country contexts. Compared to children from middle- and high-SES families, those from low-SES families may experience multiple biological and contextual risks, such as exposure to environmental toxins, disease, lack of stimulation at home, insensitive parenting and parental depression, which contributed to the early achievement gaps detected (Ip et al., 2016). However, influences at the societal level, such as the development stage of the education system, child-rearing practices and societal turmoil, might have exerted distinct but influential effects on the disparities in early academic achievement in the different country contexts. Some of the influences from low-SES related factors might not have just been negative. This was shown in the results from Vanuatu where low-SES children displayed higher levels of early mathematics achievement than their counterparts from high-SES families despite the significant path of SES → EF → early academic achievement.

Limitations

There are several limitations to this study. First, although preschool attendance and EF mediated the pathway, either independently or sequentially, from SES to early academic achievement in the three countries, caution is needed in interpreting the findings given the cross-sectional design of this study. Analyses based on longitudinal data is needed to make causal inferences. Another limitation lies in this study's lack of sample representativeness in terms of preschool attendance in each country. The validation sample from the EAP-ECDS reflected the distribution in terms of age, gender and urban/rural residence (Rao et al., 2014); however, it did

not necessarily reflect preschool attendance in the participating countries. Therefore, the existence or lack of mediating effects of preschool attendance in the different countries studied may not be replicated when samples that better reflect the situation of preschool enrolment are used. At the same time, we only had the information on preschool attendance but not the quality of the preschool children attended, which may limit our understandings on the role preschool attendance plays in the SES-related early achievement gaps in the countries. Third, we used the approach that is accepted in developed countries to generate a SES index based on parents' education, occupation and family assets. However, such an approach may not be appropriate in developing countries. For example, in Mongolia, the index used to examine the assets of non-nomadic families may not be applicable to the nomadic or semi-nomadic families that are predominant in the Mongolian countryside (Fernandez-Gimenez, 2000). Therefore, it is recommended that a more culturally appropriate and sensitive index be used when evaluating SES in different developing countries. In addition, the assessment items related to children's EF, language, literacy and math performance were all from one instrument, i.e., the EAP-ECDS. Although the EAP-ECDS is psychometrically robust (Rao et al., 2014), it is a scale to understand children's holistic development and the selected items might not completely reflect children's development in these particular areas. Finally, because we did not have data reflecting particular social and contextual factors, such as parenting practices, single- or two-parent status at home, personal well-being and societal development, we were not able to empirically examine whether or how such factors work together with preschool attendance and EF to influence early family-SES related learning achievement disparities.

Conclusions

This study is the first to focus on the existence and mechanisms of early academic achievement gaps in language, literacy and mathematics in developing countries by examining

the roles of preschool attendance and EF in Cambodia, Mongolia and Vanuatu. The SES-related early achievement gaps differed across the countries, and preschool attendance and EF were found to mediate the gaps either independently or sequentially in all of them. These findings are therefore considered to be related to the particular cultural and contextual circumstances of these countries. In addition, although preschool attendance and EF were not found to be mediators in all of the countries, the paths of preschool attendance → EF → early academic achievement were significant, indicating the importance of preschool attendance and EF to early learning achievement in language, literacy and mathematics.

Based on the results from the three countries studied, we emphasise the importance of expanding preschool access for all children and enhancing children's EF development as a valuable approach to minimising early achievement gaps in developing countries. In addition to general supportive strategies, we also strongly recommend that countries adopt country-specific approaches based on a careful examination and thorough understanding of their unique cultural practices and contextual circumstances. In this way the support can better fit the needs and situations of each individual country and ultimately narrow or close the early academic achievement gaps.

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Table 1

Descriptive statistics of analytic variables in each country

	Cambodia (n = 1,198)	Mongolia (n = 1,232)	Vanuatu (n = 771)
Age (in months) *M (SD)*	53.81 (10.36)	53.69 (9.93)	54.58 (9.70)
N. of Girls (%)	598 (49.9)	614 (49.8)	372 (48.2)
N. of rural residence (%)	550 (45.9)	607 (49.3)	685 (88.8)
N. of preschool enrolment (%)	499 (41.7)	620 (50.3)	333 (43.2)
Parental education	4.06 (1.31)	5.93 (1.18)	3.79 (0.97)
Maternal occupation			
N. of skilled agriculture & fishing (%)	441 (36.8)	82 (6.7)	206 (26.7)
N. of service worker & shop sales worker (%)	225 (18.8)	369 (30.0)	71 (9.2)
N. of craft & related worker (%)	15 (1.3)	55 (4.5)	5 (0.6)
N. of plant/machine operator & assembler	127 (10.6)	4 (0.3)	-
N. of clerk (%)	5 (0.4)	19 (1.5)	25 (3.2)
N. of associate professional and professional (%)	69 (5.7)	320 (25.9)	60 (2.3)
N. of manager & administrator (%)	8 (0.7)	58 (4.7)	4 (0.5)
N. of no employment (%)	281 (23.5)	323 (26.2)	368 (47.7)
Paternal occupation			
N. of skilled agriculture & fishing (%)	430 (35.9)	102 (8.3)	367 (47.6)
N. of service worker & shop sales worker (%)	234 (19.5)	406 (33.0)	79 (10.2)
N. of craft & related worker (%)	102 (8.5)	65 (5.3)	44 (5.7)
N. of plant/machine operator & assembler	186 (15.5)	49 (4.0)	87 (11.3)
N. of clerk (%)	36 (3.0)	10 (0.8)	21 (2.7)
N. of associate professional and professional (%)	138 (11.5)	319 (25.9)	77 (10.0)
N. of manager & administrator (%)	40 (3.3)	85 (6.9)	14 (1.8)
N. of no employment (%)	4 (0.3)	129 (10.5)	2 (0.3)
Family asset *M (SD)*	5.07 (2.30)	6.67 (1.34)	3.08 (1.99)

SES (Range)	-2.16 – 3.65	-3.30 – 2.72	-2.30 – 4.10
EF (Range)	-2.36 – 1.83	-2.01 –1.93	-1.96 – 1.79
Math (Range)	-1.69 – 2.92	-1.75 – 3.13	-1.45 –2.90
Language (Range)	-2.83 – 2.07	-4.49 – 2.24	-2.29 – 1.96
Literacy (Range)	-1.73 – 2.43	-3.01 – 2.10	-1.71 – 1.98

Note. As the scores for SES, EF, Math, Language and Literacy were standardized, the range of standardized scores were presented here.

Table 2

Correlations between variables of interest in this study across three countries

	1	2	3	4	5	6	7	8	9
Cambodia									
1. Age	–								
2. Gender	.00	–							
3. Urbanicity	.03	-.01	–						
4. Preschool Attendance	.45***	-.04	.23***	–					
5. SES	-.04	.00	.55***	.20***	–				
6. EF	.62***	-.03	.16***	.41***	.05	–			
7. Math	.62***	.00	.23***	.40***	.11***	.72***	–		
8. Language	.53***	-.05	.19***	.34***	.09**	.58***	.57***	–	
9. Literacy	.63***	-.04	.28***	.54***	.22***	.66***	.71***	.59***	–
M	53.81	0.50	0.54	0.42	0	0	0	0	0
SD	10.36	0.50	0.50	0.49	1	1	1	1	1
Mongolia									
1. Age	–								
2. Gender	-.01	–							
3. Urbanicity	.04	-.00	–						
4. Preschool Attendance	.05	.00	-.00	–					
5. SES	-.02	.01	.19***	.29***	–				
6. EF	.68***	-.08**	.04	.19***	.13***	–			
7. Math	.72***	-.05	.05	.19***	.17***	.77***	–		
8. Language	.55***	-.09**	.07**	.18***	.16***	.61***	.60***	–	
9. Literacy	.71***	-.14***	.07**	.20***	.17***	.72***	.76***	.66***	–
M	53.69	0.50	0.51	0.50	0	0	0	0	0
SD	9.93	0.50	0.50	0.50	1	1	1	1	1
Vanuatu									
1. Age	–								
2. Gender	-.01	–							
3. Urbanicity	.04	-.01	–						
4. Preschool Attendance	.05	.00	-.00	–					
5. SES	-.02	.01	.19***	.29***	–				
6. EF	.67***	-.08**	.04	.19***	.13***	–			
7. Math	.72***	-.05	.05	.19***	.17***	.77***	–		
8. Language	.55***	-.09**	.07*	.18***	.16***	.61***	.60***	–	
9. Literacy	.71***	-.14***	.07*	.20***	.17***	.72***	.75***	.66***	–
M	54.58	0.52	0.11	0.43	0	0	0	0	0
SD	9.70	0.50	0.32	0.50	1	1	1	1	1

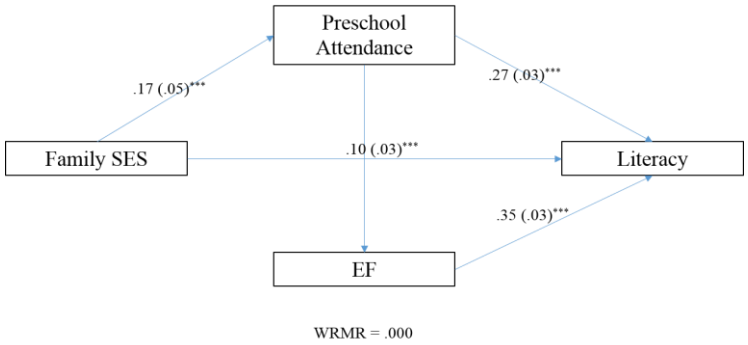
Note. * $p < .05$; ** $p < .01$; *** $p < .001$

Table 3

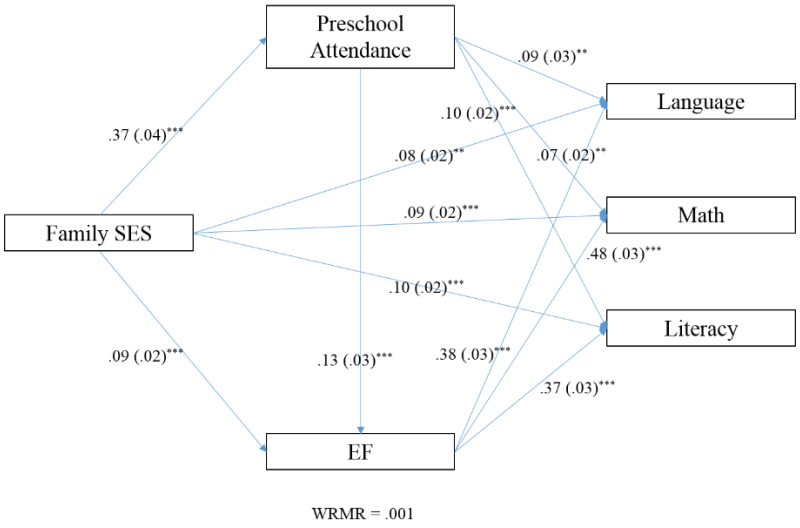
Direct paths between SES, preschool attendance, EF, and performance in math, language, and literacy in each country controlling for child age, gender, and urbanicity

	Cambodia	Mongolia	Vanuatu
Model 1:			
SES → Preschool Attendance β (SE)	.22 (.05)***	.40 (.04)***	.07 (.05)
SES → EF β (SE)	-.03 (.03)	.11 (.02)***	.07 (.04)*
Model 2:			
SES → Math β (SE)	.03 (.03)	.19 (.02)***	-.09 (.04)*
SES → Language β (SE)	.01 (.03)	.17 (.02)***	.10 (.04)**
SES → Literacy β (SE)	.14 (.03)***	.18 (.02)***	.06 (.03)
Model 3:			
Preschool → EF β (SE)	.13 (.03)***	.11 (.02)***	.09 (.04)*
Model 4			
Preschool → Math β (SE)	.04 (.02)	.15 (.02)***	.23 (.03)***
Preschool → Language β (SE)	.02 (.03)	.15 (.02)***	.09 (.03)**
Preschool → Literacy β (SE)	.20 (.02)***	.16 (.02)***	.25 (.03)***
EF → Math β (SE)	.50 (.02)***	.53 (.02)***	.61 (.03)***
EF → Language β (SE)	.37 (.03)***	.44 (.03)***	.62 (.03)***
EF → Literacy β (SE)	.37 (.02)***	.42 (.02)***	.53 (.03)***

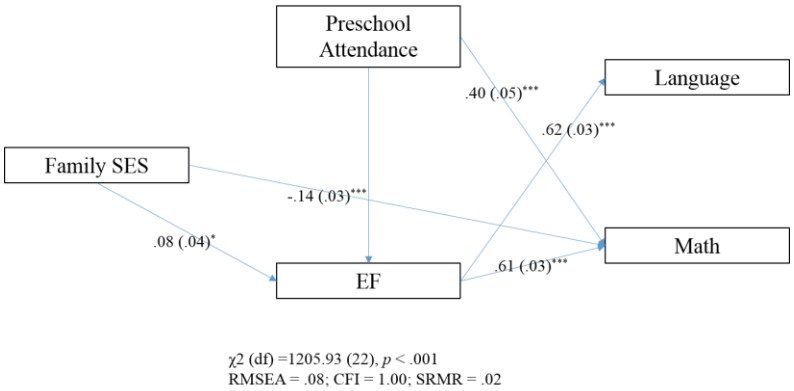
Note. * $p < .05$; ** $p < .01$; *** $p < .001$



a. Cambodia



b. Mongolia



c. Vanuatu

Note. Only significant paths were presented controlling for child demographic variables.

Figure 1. Models with the mediating effects of Preschool Attendance and EF for three countries