



# Preschool expenditures and Chinese children's academic performance: The mediating effect of teacher-child interaction quality



Bi Ying Hu<sup>a</sup>, Yisu Zhou<sup>a</sup>, Liang Chen<sup>b,\*</sup>, Xitao Fan<sup>a</sup>, Adam Winsler<sup>c</sup>

<sup>a</sup> University of Macau, Avenida da Universidade, Taipa, Macau, China

<sup>b</sup> Shandong Normal University, No.88 East Wenhua Road, Jinan 250014, China

<sup>c</sup> Department of Psychology, 3F5 George Mason University, Fairfax, VA 22030, United States

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## ABSTRACT

This study examined the relationship between investment of financial resources in early childhood education (ECE) and student academic outcomes using survey and observational data from 59 classrooms in Guangdong Province, China ( $N = 589$ , 50% girls, and  $M_{\text{age}} = 5.1 \pm 0.42$  years). We conceptualized the mediating role of teacher-child interaction as an important mechanism that can explain the effects of financial resources. Three types of interactions were considered under the Classroom Assessment Scoring System (CLASS) framework: emotional support, classroom organization, and instructional support. Our multilevel structural equation models indicated that investing in teacher training has a direct positive effect on student vocabulary development, and that neither teacher salary nor school facility has a direct effect on child vocabulary, math, or science outcomes. Giving higher pay to teachers has an indirect effect through increased quality of teacher-child interactions. In particular, the effect of instructional support is most salient for all three outcomes. We discuss our results in light of the recent push by the Chinese government to invest in ECE. We argue for prioritizing support for raising teacher pay to attract more capable talent to the teaching pool, expanding teacher development programs to increase instructional quality, and spending less on equipment.

## 1. Introduction

When there is a serious shortage of public investment in early childhood education (ECE) or money is spent ineffectively, government initiatives fail to align with educational equity goals (Heckman, 2006). One of the direct consequences of the lack of public funding for ECE is an increase in the number of children—often those who are socio-economically disadvantaged—entering their formal school years without the adequate skills, knowledge, and dispositions necessary for academic and lifelong success. This is a pressing concern in China. Although recent economic boosts have successfully lifted hundreds of millions of families out of poverty, China continues to suffer the consequences of ill-balanced development between urban and rural regions socially, economically, and educationally, and ECE is one of the most adversely affected areas (Hu & Li, 2012; Hu & Roberts, 2013). Having been playing Cinderella to her two stepsisters—primary and secondary education nationwide—ECE received only 1.3% of the total funding for education before 2010, which was gradually increased to 3.24% in 2014 (Ministry of Education, 2014). Most of the limited ECE budget has traditionally been (and continues to be) reserved for urban public

programs run by local government agencies (Hu & Roberts, 2013; Zhao & Hu, 2008). As China's central government has set ambitious goals for universalizing and improving the quality of three-year ECE for all children aged three to six by 2020, local governments across the nation are under pressure to reform existing funding and expenditure structures to support the development of high-quality ECE.

ECE quality that nurtures children's development can be defined as structural and process quality. Structural quality—such as teachers' professional qualifications, salary, teacher-child ratio—are the regulable aspect of ECE, and they represent distal quality, setting pre-conditions of proximal process quality (Cryer, 1999). Proximal process quality consists of children's moment-to-moment experiences in the ECE settings, their academic and social exchanges with peers, adults, and classroom materials which fosters their social, emotional, and academic development (Pianta et al., 2005). So far, research provides abundant evidence that structural and process quality are related to children's social and pre-academic performance (Connor, Morrison, & Slominski, 2006; Howes et al., 2008; Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009). What is noteworthy is that research has typically found stronger associations between process

\* Corresponding author at: School of Psychology, Shandong Normal University, Jinan, China.  
E-mail address: [chen\\_liang1010@126.com](mailto:chen_liang1010@126.com) (L. Chen).

quality and child outcomes than structural quality and child outcomes (Howes et al., 2008; Mashburn et al., 2008; NICHD Early Child Care Research Network, 2002). However, much less evidence exists regarding the mediational role that process quality may play between structural quality and children's outcomes, especially for structural variables related to school finance, such as school expenditures on teachers' compensation, assets, and professional development. We know that school finance contributes to student achievement (Greenwald, Hedges, & Laine, 1996; Krueger, 2003), but we are less aware of the processes within schools that link expenditures to child outcomes (Rice & Schwartz, 2008). In terms of the correlation between school finance and children's pre-academic skills (i.e., vocabulary/language, emergent literacy, math, science, fine motor, social and behavioral skills; Winsler et al., 2008), researchers have recently moved away from global research questions about overall levels of spending, and instead are more interested in the specific items purchased and the particular uses made of school funding (Rice & Schwartz, 2008).

In China, ECE has undergone a promising transformation to meet the national goal of improving program quality. Program leaders, researchers, and policy makers are seeking guidance on ECE expenditures — on what specific items should be purchased with preschool funding so that limited financial resources can produce maximized effects on children's pre-academic skills and socio-emotional wellbeing. However, we have little knowledge of how relations between expenditures, ECE quality, and children's academic performance work. Therefore, by examining how ECE process quality functions as part of the process that links kindergarten expenditures to children's academic outcomes during early childhood, the current study advances previous research on ECE quality and children's outcomes. Specifically, this study fills a gap in the literature by investigating the effects of specific ECE expenditures on children's pre-academic performance, and the role that classroom process quality (i.e., teacher-child interactions) plays in potentially mediating between ECE expenditures and children's pre-academic performance.

### 1.1. ECE process quality: the teacher-child interaction framework

The current frontier of ECE research hinges on one important concept: process quality. Researchers have sought to identify the specific aspects of process quality in ECE classrooms that are most pivotal to children's development and learning across cultures (Hu, Fan, Gu, & Yang, 2016). A widely used framework for measuring ECE quality is the *Teaching Through Interactions* (TTI) framework developed by Pianta, LaParo, and Hamre (2008). This framework is conceptualized around moment-to-moment teacher-child interactions and their relations with children's social and academic growth. Building on previous descriptions of effective teaching (Brophy & Good, 1986; Eccles & Roeser, 2005), Pianta, LaParo et al. (2008) developed the observational tool called the *Classroom Assessment Scoring System* (CLASS) to pinpoint teaching behavior in the classroom through three distinct domains: emotional support, classroom organization, and instructional support. Classrooms with high emotional support are positive and warm learning environments in which children have a secure and close attachment to the teacher who is sensitive to children's learning and emotional needs. A high score in classroom organization indicates that children are constantly engaged in activities and routines and that teachers provide clear, consistent directions and expectations, and utilize a variety of activities and learning modalities to help children learn. A high score in instructional support suggests that teachers use effective strategies that produce opportunities for young children to develop higher-order thinking skills, creativity, and complex language skills.

Empirical evidence robustly supports a positive association between process quality and children's social and academic development, albeit a moderate one (Campbell & Ramey, 1995; Greenberg, Domitrovich, & Bumbarger, 2001; Hamre & Pianta, 2007; Helburn,

1995; Howes & Hamilton, 1993; Kisker, Hofferth, Phillips, & Farguhar, 1991; Kontos & Wilcox-Herzog, 1997; Phillips, Mekos, Scarr, McCartney, & Abbott-Shim, 2000; Yoshikawa et al., 2015). In terms of children's pre-academic skills, studies have typically focused on children's cognitive and language development, often using measures such as the Peabody Picture Vocabulary Test – Revised (PPVT-R; Dunn & Dunn, 1981) and the Test of Early Mathematics Ability (TEMA; Ginsburg & Baroody, 1983, 1990). Recently, however, researchers have started to pay more attention to pre-academic gains in children's science knowledge (Greenfield, 2009, 2015; Kinzie et al., 2014). Children's early science knowledge is predictive of later learning (Duncan et al., 2007; Grissmer, Grimm, Aiyer, Murrah, & Steele, 2010) and science gains are importantly related to children's executive functioning (Nayfeld, Fuccillo, & Greenfield, 2013).

Although originated in the U.S., the CLASS has been applied in numerous studies in multiple countries (Cadima, Leal, & Burchinal, 2010; Leyva et al., 2015; Pakarinen et al., 2010; von Suchodoletz, Fäsche, Gunzenhauser, & Hamre, 2014). Findings from these studies concluded that variation in teacher-child interaction quality as measured by the CLASS is associated with meaningful differences in students' learning across cultures. Recently, Hu, Roberts, Jeong, and Guo (2015) showed that the CLASS exhibits the same (or very similar) factor structures as found in U.S. samples, and provided strong psychometric evidence for its applicability in Chinese preschool (“kindergarten”) settings.

### 1.2. Evidence-based policy supporting ECE: do expenditures matter?

Researchers have reached consensus that only when a government invests in ECE to ensure adequate process quality will investments truly make a difference in children's outcomes (Burchinal et al., 2008; Gilliam & Zigler, 2004; Mashburn et al., 2008; Pianta, 2009; Wong, Luo, Zhang, & Rozelle, 2013). Evidence of the long-term impact of high-quality ECE programs is largely based on randomized trials, such as the Abecedarian Project and the High Scope Perry Preschool projects, that showed benefits exceeding their cost, ranging from 5 to 16 dollars of return on investment for each dollar invested in the program (Arteaga, Humpage, Reynolds, & Temple, 2014; Campbell et al., 2014; Reynolds, Temple, Ou, Arteaga, & White, 2011). Governments worldwide are now increasing their financing commitments to help improve the quality and availability of ECE programs, especially for children in poverty (Gilliam & Zigler, 2004; Kagitcibasi, Sunar, Bekman, Baydar, & Cemalcilar, 2009; Sharma & Nagar, 2009). Most importantly, to maximize the effectiveness of such investments, it is critical to understand how ECE expenditures are associated with different elements of teacher-child interaction quality and, in turn, to children's pre-academic skills.

In the mainstream economics of education literature, the role of financial input has always captured the attention of researchers. Hanushek's (1986) meta-analysis first claimed that school inputs matter little in determining student learning outcomes. This argument has been disputed by others, who have found a positive relationship between financial resources and student achievement (Greenwald et al., 1996; Krueger, 2003). School expenditure is usually used as an indicator of financial resources. In a typical input-output model, however, the process occurring within schools is usually treated as a “black box” (Rice & Schwartz, 2008), where the variation in output (student test scores) is modeled by only variation in inputs (per-child spending, class size, teachers, etc.). However, such studies are inconclusive which has led researchers to shift their focus away from overall levels of spending to more specific purchases and uses made of school financial resources (Rice & Schwartz, 2008).

In China, the most frequently occurring preschool expenditures consist of three elements: school facilities (maintenance, office and classroom equipment, lab consumables, etc.), teacher compensation (salary, subsidy, performance pay, health care, etc.), and services

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