Abstract

Two studies examined the relationship between preschool experiences and the early academic achievement of rural Chinese children. In both Study 1 (n = 165) and Study 2 (n = 205), the school preparedness, and the literacy and mathematics attainment of first graders with different preschool experiences (kindergarten, separate pre-primary class, “sitting-in” a Grade 1 class, no preschool experience) were assessed. In Study 1, attainment was evaluated using end-of-semester examinations designed by local educational authorities; whereas in Study 2, better-constructed and identical tests were administered at the beginning and end of the academic year. Further, in Study 2, the different types of preschool programs attended by participating children were directly observed. Findings from both studies showed that children with developmentally appropriate preschool experiences (kindergartens or separate pre-primary classes) had higher school readiness scores than other children. Results from Study 2 also indicated that (i) disparities in children’s school attainment were associated with the type of their preschool experience; and (ii) children from the 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. Implications of the findings for the scaling up of preschool services in rural China are discussed.

Keywords: early childhood education, preschool quality, achievement, Chinese, rural

Early Achievement in Rural China: The Role of Preschool Experience

This paper considers the relationship between varying preschool experiences and children's knowledge at school entry and learning over the period of one year in a poor, rural Chinese context. In China, the age of school entry varies across regions and is either six or seven years. Currently, millions of children in China do not receive any preschool services before they start Grade 1. The Gross Enrolment Ratio (GER) for pre-primary education (four- to six year-olds) in China was 39 in 2006 (UNESCO, 2008). This figure, expressed as a percentage, reflects the total number of children in pre-primary education relative to the total population of 4- to 6-year-olds in China. Poverty and maternal education are distinct barriers to children's enrolment in preschool programs (Nonoyama-Tarumi, Loaiza, & Engle, 2010; UNESCO, 2009), and parents in rural China are poorer and have lower levels of education than their urban counterparts. Their children are also less likely to attend preschools; in 2007, the GERs for children ranging in age from three to six years in China were 55.6 and 35.6 for urban and rural areas, respectively (National Bureau of Statistics of China, 2008). Extrapolating from official figures, this means that while over 17 million 3- to 6-year-olds from rural areas attended prior-to-school programs, another nearly 32 million did not (Government of China, 2007). This highlights the dearth of early childhood services in rural China.

Benefits of Preschool Attendance

Numerous studies have examined the association between preschool attendance and the development of children from socially disadvantaged backgrounds. These studies have varied in terms of their methodological rigor, the quality of program studied, and the national representativeness of their samples. They have used randomized control trials, quasi-experimental designs, or prospective longitudinal designs, and they have been conducted

in different countries. Reviews of studies conducted in the United States (Barnett, 1998) and in the developing world (Engle et al., 2007) have confirmed the benefits of preschool attendance for participating children. From Ypsilanti, Michigan (Schweinhart et al., 2005) to Bangladesh (Aboud, 2006) to four countries in East Africa (Mwaura, Sylva, & Malmberg, 2008), children from economically deprived backgrounds who attended preschool programs have been found to have better developmental outcomes than those who did not. A review of recent studies which considered the effects of early childhood programs on the cognitive development of children from different parts of the world found that children from socially disadvantaged backgrounds were the main beneficiaries of preschool programs and confirmed the positive effects of enrolment in such programs. However, although such programs yielded considerable short-term effects, their long-term effects were smaller, which led to the conclusion that early childhood programs cannot fully compensate for the less favorable learning environments to which disadvantaged children are exposed (Burger, 2010).

Nevertheless, preschool experience is still clearly important for children from socio-economically disadvantaged backgrounds. Why is it effective? Children who are disadvantaged typically have less stimulating family environments and fewer resources for learning in the home and in the community. Holistic early intervention programs for these children can compensate for their relatively less favorable family circumstances and can reduce disparities in school readiness and achievement. According to the cognitive advantage hypothesis (Reynolds, Marvogenes, Bezruczko, & Hagemann, 1996; Reynolds & Ou, 2003), preschool participation promotes school preparedness and continues to benefit children throughout their school years. Therefore, in these cases, preschool programs have “helped level the playing field for disadvantaged children as they entered primary school” (UNESCO, 2006, p. 113).

Large-scale studies conducted in Europe and the United States have confirmed the influence of preschool attendance on cognitive or academic outcomes for children from disadvantaged groups. More recent analyses of the data from the NICHD Study of Early Child Care and Youth Development (Dearing, McCartney, & Taylor, 2009), which importantly corrected for confounding factors such as selection biases, indicate that children from low-income families who had received high-quality child care during their early years had higher mathematics and reading achievement than children from low-income families who had not received high-quality care. As a result of these studies, the beneficial effect of preschool participation on the development of children from socio-economically disadvantaged families is generally accepted. However, there is a caveat - the quality of this experience matters.

Preschool Quality Matters

Preschool quality and child development. In the developed world, large-scale longitudinal studies conducted in the United States (e.g., Cost, Quality, and Outcomes, 1995; NICHD ECCRN, 2005) and in the United Kingdom (Sylva et al., 2006) have documented a positive relationship between child care quality and child development outcomes. These studies have assessed the quality, quantity, and type of child care at regular intervals. The Cost, Quality, and Outcomes study found that there was a positive relationship between preschool quality and children's language and mathematical competence in Grade 2. Results from the NICHD ECCRN study, which followed over 1,300 children from 10 sites from birth, indicated that high-quality care was related to better cognitive outcomes, less impulsivity, and better social competence at 4.5 years of age (NICHD ECCRN, 2005). The Effective Provision of Pre-school Education (EPPE) study, which assessed a nationally representative sample of over 3,000 children at ages three, five, and seven in the United Kingdom, found that participation in higher-quality

preschools was associated with better language, cognitive, and social development (Sylva et al., 2006).

Few studies in the developing world have assessed the relationship between preschool quality and child development, and even fewer have assessed it concurrently and longitudinally (Myers, 2006). It has been argued that definitions of preschool quality should be culturally and contextually relevant. Given wide variations in economic development, resource availability, and cultural beliefs, definitions of high quality will vary across contexts (Pence & Moss, 1994). Nevertheless, there is general agreement about the factors which define high preschool quality regardless of circumstance. These include the physical environment for learning, curriculum, learning and teaching approaches, teacher-child interactions, program management, and community integration (Association for Childhood Education International, 2006).

Studies conducted in Bangladesh (Aboud, 2006; Moore, Akhter, & Aboud, 2008) have evaluated the relationship between preschool quality and child outcomes. In these studies, adaptations of the Early Childhood Environment Rating Scale – Revised (ECERS-R) (Harms, Clifford, & Cryer, 1998) were used to evaluate quality. Aboud (2006) compared 400 4.5- to 6.5-year-olds from rural Bangladesh with different preschool experiences and found that children who had been enrolled in preschool programs performed better on measures of vocabulary, verbal and nonverbal reasoning, school readiness, and on some indicators of social development than those without preschool experience. Further, preschool quality was positively related to group averages in verbal and non-verbal reasoning. Moore et al. (2008) compared 71 children who had attended higher-quality pilot preschool programs to 67 children who had attended lower-quality preschool programs and found that children from the higher-quality programs made significantly more gains on non-verbal reasoning skills and school readiness than those

who attended lower-quality programs.

Preschool quality and program type. Center-based programs tend to offer higher-quality services than home-based ones. Fuller, Kagan, Loeb, and Chang (2004) observed the quality of 166 centers and 187 non-parental home settings serving low-income children in the U.S. and found that centers displayed higher mean quality (assessed on the basis of teacher qualifications and the intensity of structured learning activities) than home-based settings. In a quasi-experimental design, Rao and Pearson (2007) used stratified random sampling to select 1,312 Cambodian children. They found that children attending preschool programs located in primary schools had better developmental outcomes one year before and just before entering Grade 1 than those who had attended less formal community preschools, home-based programs, and no programs (control group). Children who received any form of preschool education had significantly better developmental functioning than those in the control group. Aboud, Hossain, and O'Gara (2008) also found that the quality of preschool was related to child outcomes in Bangladesh, but that there were no differences in the Grade 1 competencies of children receiving the same program in either home-based or school-based preschools.

Taken together, existing research confirms that children from disadvantaged backgrounds benefit from preschool participation (e.g., Aboud, 2006; Aboud et al., 2008; Campbell, Ramey, Pungell, Sparling, & Miller-Johnson, 2002; McCartney, Dearing, Taylor, & Bub, 2007; Ramey & Ramey 2004; Rao & Pearson, 2007; Schweinhart et al., 2005). Early childhood programs reduce achievement gaps related to economic disparities and the quality of early educational experience matters for child development (e.g., Moore et al., 2008; NICHD ECCRN 2000a). As mentioned earlier, there have been few systematically conducted studies on the impact of type of preschool experience on child development in developing countries. To fill this gap, the present research

examined relationships among type of preschool experience, children's school readiness, and early achievement in rural China.

Early Childhood Education in China

According to the Compulsory Education Law of the People's Republic of China (National People's Congress, 2006) the age of primary school entry is six years, but backward and rural regions may postpone school entry to seven years. State-issued documents indicate that there are three main types of early childhood centers in China: *nurseries*, which provide care for children from birth to three years of age; *kindergartens*, which provide care and education to children between three and six, or seven years of age; and *pre-primary classes*, which cater to the needs of children from five to six or seven years of age, and which are typically attached to rural primary schools. As in other countries, the state publishes regulations for kindergartens. In 1989, the State Education Commission issued the very influential *Regulations on Kindergarten Education Practice*. This was a watershed for early childhood education as the concepts of developmental appropriateness and individual needs were deemed key principles in preschool education. The *Regulations* stated that kindergartens should promote holistic development and that play should be the dominant activity in kindergartens; teachers were to respect children's choice in play and at the same time provide appropriate guidance to children (State Education Commission, 1989).

Preschool services in rural China. The majority of China's population (57%) live in rural areas, and China's rapid and remarkable economic growth has exacerbated income inequalities across different sectors of society. There are also significant disparities in the educational experiences of urban and rural children, with an increasing urban-rural gap in access to kindergartens over the past decade (Corter, Janmohammed, Zhang, & Bertrand, 2006).

Preschool-age children in rural China can attend kindergartens, a pre-primary class, or the Grade 1 class in a primary school. Kindergartens, which are managed by educational authorities or communities, provide formal early childhood education (ECE) and usually have child appropriate furnishings, toys, and educational materials. Consistent with curriculum guidelines, play-based methods are typically used, although children learn basic concepts, academic instruction is not a focus. Teachers have basic training in ECE, and their salaries are typically above the median local income. However, kindergartens are only common in larger towns, and children from smaller or more remote rural area do not have easy access to them.

Another form of ECE in rural China is the pre-primary class. Many rural primary schools have a separate class for 5- to 6-year-olds to help them to adapt to a formal school environment prior to their enrolment in Grade 1. We refer to this type of provision as a separate pre-primary class (separate preschool group). In view of their objectives, elements of the Grade 1 syllabus form part of the pre-primary curriculum. Children sometimes have time for free play, but few toys are provided. Teachers in these classes do not typically have formal teaching qualifications, but because of their accessibility and their focus on enhancing rural children's school-preparedness, separate pre-primary classes are an important form of ECE in rural China (Niu, 2004).

Some rural primary schools allow children below seven years of age to attend Grade 1 classes so that they can have some exposure to formal learning environments before they officially start Grade 1 and because of the absence or lack of affordability of other types of early childhood services. We refer to this as the "sitting-in" experience (sitting-in group). The 3- to 7-year-olds attending Grade 1 classes receive exactly the same instruction and follow the same schedule as children officially enrolled in Grade 1. These classes typically have one teacher

regardless of class size. The teacher has a formal qualification for teaching primary school, but very rarely has professional qualifications to teach children below six years of age. Thus, whole group instruction may be the normal activity in these ECE programs, rather than the active-learning, child-centered approach recommended in curriculum documents (Zhu & Wang, 2005). Commonalities and differences among these three programs are illustrated in Table 1.

In addition, there are private kindergartens in some rural areas, but unlike those in urban areas, these usually employ women without formal teaching qualifications. These kindergartens typically focus on care rather than on both care and education (Li, 2006). Other less formal early childhood services such as activity centers and game groups provide ECE opportunities for children in minority, remote, and poor areas. However, the shortage of qualified teachers, lack of resources, and their irregular schedules adversely affect the quality of these services.

Scaling up ECE in rural China. Since ECE programs provide strong foundations for subsequent learning and development; compensate for disadvantage and exclusion; and provide benefits for children, families, and societies (UNESCO, 2006), there has been a significant policy emphasis on promoting ECE in rural China, and scaling-up is underway (Chinese National Centre for Education Development Research & Chinese National Commission for UNESCO, 2008). Scientific research provides a sound foundation and is vital for policy decision making (McCall, 2009). Research evidence concerning the association between different preschool experiences, and rural Chinese children's later development is very limited but sorely needed to inform policy decisions about scaling up ECE programs.

Overview of the Current Studies

To our knowledge, no study has systematically examined children's learning experiences in different forms of ECE programs in rural China and how these experiences relate to children's

learning outcomes. Against this background, this study investigated the relationship between enrolment in different preschool programs and child development and achievement. We conducted our work in two villages in Guizhou, which is considered a “backward” province compared to provinces in the east. The two villages were comparable in terms of low GERs for pre-primary education, and three forms of ECE (kindergartens, separate pre-primary classes, and sitting-in classes) existed in the districts in which the two villages were located. The formal entry age to Grade 1 in these villages was seven years.

These studies had two objectives: (1) To systematically examine the relationship between preschool experience and children’s learning outcomes after they had entered primary school in rural China. Research has indicated that preschool experiences are the most discernable and stable in the realm of cognitive development (NICHD ECCRN, 2000a). Therefore, we focused on children’s cognitive development and assessed these outcomes in terms of children’s school readiness skills and academic achievement; and (2) To gain a better understanding of the nature of children’s early learning experiences in the different types of ECE programs that these children had attended.

Study 1 and Study 2 addressed the first objective and compared children with different ECE experiences at the beginning and/or middle, and end of Grade 1. It was anticipated that children with preschool experience would show better achievement than those without it and that children from kindergarten classes would show higher achievement than those who had attended separate pre-primary classes or merely “sat in” Grade 1 classes.

Study 2 also addressed the second objective. Systematic classroom observations in the three different types of ECE programs in the two villages were conducted in order to compare structural quality, learning environments, and teaching activities. There was only one

kindergarten in the county where we conducted our study, and we assumed that it would have a higher level of structural quality, a better learning environment, and more child appropriate learning activities than both the separate pre-primary and Grade 1 classes. At the same time, we expected that teachers of separate pre-primary classes and kindergartens would provide more individual attention to children than teachers who taught preschool-aged children who were sitting in Grade 1 classes. We also expected that the type of experience in the non-academic, developmentally appropriate kindergarten would be more evident in children's performance at the end of Grade 1 (Summer) than at the start of Grade 1 (Fall). This is because we felt that this type of preschool experience might encourage the kinds of approaches to learning that promote interest and achievement in the early primary school years (Katz & Chard, 2000).

Study 1

Method

Participants. All Grade 1 students (92 boys, 89 girls) in nine of the 10 primary schools in ABC County, Guizhou, during the 2006-07 academic year participated in the study. The primary school that was excluded was located in an extremely remote area. Based on information from parent/ guardian interviews, children had attended the kindergarten, separate pre-primary classes, "sat in" Grade 1 classes, or had no preschool experience. Children in all three program groups received only one form of early childhood education as all programs were full-day in duration, and none of the children had experience of more than one preschool program. Because of the relatively small numbers of children who "sat in" Grade 1 classes and those who did not have any preschool experience in the nine primary schools, we recruited an additional 22 Grade 1 students who had not attended any ECE program (11 children), or had "sat in" a Grade 1 class (11 children) in a primary school in the adjacent county. Hence a total of 203 children

participated in at least one of the assessments conducted in Study 1. Our analyses focus on the 165 children who completed both the School Readiness Composite (SRC) assessment and at least one wave of school achievement tests. There were no significant differences between children who completed the Summer tests and those who did not. Most of the children who did not complete the end-of-year assessment had left this region with their parents, who were typically migrant workers in urban areas. There were no differences in either literacy or mathematics attainment at the end of Semester 1 (G1 Winter) between those children who completed the assessments at the end of Semester 2 (G1 Summer) and those who did not.

Table 2 provides demographic information on the children with different preschool experiences and their families. Children were an average of 85.9 months of age when they entered Grade 1, and there were no significant differences in age across groups. The majority of children (81.3%) had siblings at home, and 71% of reported annual families incomes below ￥8000 (about USD 1,200), which is much lower than the average family annual income in rural China. Mothers had an average of 83 months of formal education, and those with some education tended to send their children to either kindergartens or separate pre-primary classes. On the other hand, mothers with no or very limited formal education were more likely to send their children to "sit in" Grade 1 classes or not to send them to preschool.

Measures.

School Readiness Composite. The School Readiness Composite of the Bracken Basic Concept Scale-Revised (BBCS-R) was used to assess children's school preparedness. The BBCS-R is widely used to measure basic concept acquisition and receptive language skills for children ranging in age from two years six months to seven years 11 months. It includes 308 foundation and functionally relevant educational concepts in 11 subtests (Bracken, 1998). The

first six subtests: colors, letters, numbers and counting, sizes, comparisons, and shapes, comprise the School Readiness Composite (SRC). The BBCS-R was translated into Mandarin Chinese by bilingual researchers and a back-translation procedure was used to assess the accuracy of the translation. In Study 1, the letters subtest was not administered because knowledge of the English alphabet is not considered a prerequisite for primary school. There are no Chinese norms for the BBCS-R, but our research did not intend to rate children's development according to the norms; rather, it aimed to determine whether children with varying ECE experiences differed in terms of their mastery of basic concepts at the beginning and end of Grade 1. Cronbach's alpha for the G1 Fall SRC (without literacy section) was .93.

Academic achievement. We obtained children's scores on two end-of-semester literacy and mathematics examinations taken in January (G1 Winter) and June (G1 Summer) from school records. These examinations were developed by local educational authorities, and test items were aligned with the *Primary School Curriculum Guide*. We did not have access to these tests but know that the test items varied across semesters.

Procedure. Trained research assistants who were blind to children's preschool experiences administered the SRC (without literacy) three weeks after the beginning of the academic year (G1 Fall). Children's results in literacy and mathematics examinations taken in January (G1 Winter) and June (G1 Summer) were obtained from school records. All primary schools in the study used the same examinations which were administered during scheduled class time. Parents or guardians were interviewed after school hours, in individual sessions, to obtain demographic information and children's preschool experiences before Grade 1.

Results

School Readiness Composite. An ANCOVA with preschool experience as the

between-subjects variable and maternal education as the covariate was conducted to examine the relationship between children's preschool experiences and their school preparedness (SRC without literacy). The main effect of preschool experience was significant, F (3, 160) = 32.72, p < .001, η_p^2 = .38. Children who attended kindergarten before Grade 1 performed significantly better than other children on the SRC test (without literacy) (Kindergarten: *adjusted mean* = 58.15, *SE* = 1.40; separate pre-primary class: *adjusted mean* = 47.40, *SE* = 1.22; sitting-in group: *adjusted mean* = 37.54, *SE* = 1.74; no preschool experience: *adjusted mean* = 37.44, *SE* = 2.54). Further, children who attended separate pre-primary classes also performed significantly better than children from both the sitting-in and no preschool experience groups.

Academic achievement. Since the tests for academic achievement were different between the G1 Winter and Summer assessments in Study 1, we conducted separate ANCOVAs to examine the relationship between preschool experiences and children's Grade 1 academic achievement. Maternal education was the covariate in the ANCOVAs for the G1 Winter Scores. In addition, the relevant Grade 1 Winter score was a covariate for the G1 Summer attainment scores.

ANCOVAs for G1 Winter attainment tests showed a significant effect of preschool experience on both children's literacy, F (3, 160) = 6.06, p < .01, η_p^2 = .10, and mathematics achievement, F (3, 160) = 7.15, p < .001, η_p^2 = .12. Children in the kindergarten group had significantly higher literacy achievement than children in the sitting-in and control groups (see Figure 1). There was a different pattern of results for children's mathematics achievement at G1 Winter. Children from the kindergarten group performed better than children from the separate pre-primary and sitting-in groups (see Figure 2). However, the ANCOVAs with G1 Summer data did not yield any significant main effects of preschool experience for either literacy or

mathematics achievement.

Results are to some extent consistent with our prediction that children with any ECE experience would do better than the control group. As expected, children who had attended kindergartens had better school readiness skills, and literacy and mathematics achievement in the Winter than children in the sitting-in and control groups. Children who had attended separate pre-primary classes showed higher levels of school readiness skills than those from the sitting-in and control groups. Unexpectedly, we did not find significant group differences on the Grade 1 Summer attainment tests. We believed that these results were a function of the academic achievement tests used in Study1 and we used a different set of tests in Study 2.

Study 2

In addition to replicating Study 1, Study 2 was designed to be more comprehensive than the first study. For example, we did not systematically observe the different types of ECE programs in Study 1. Prior research has repeatedly shown that children who attend higher-quality ECE programs have better outcomes than children who attend programs of lower quality (e.g., Barnett, 1998; Cost, Quality, and Outcomes, 1995; Dowsett, Huston, Imes, & Gennetian, 2008; NICHD ECCRN, 2005; Sylva et al., 2006). Based on our informal observations and familiarity with ECE programs in rural China, we believed that the child-centered environment of kindergartens facilitated both children's mastery of basic concepts and, importantly, their approaches to learning. The latter is more difficult to assess directly, but is considered an important facet of school readiness. The academic orientation and teacher attention in separate pre-primary classes may also facilitate children's academic learning. However, being placed in a Grade 1 class with little individual attention from the teacher and few age-appropriate activities may not promote children's early attainment. In order to assess these speculations, we

systematically examined the nature of learning experiences in these three ECE programs in Study 2.

It should be noted that literacy skills were not included in the SRC in Study 1. Given the importance of literacy skills in the early years and for later school achievement, we felt that it was important to include an assessment of literacy concepts in our examination of children's school preparedness. Study 2, therefore, included the literacy concepts in the SRC.

We were surprised to note that children from the sitting-in group did not differ from those with no preschool experience in the tests of school readiness and academic attainment. We wondered whether the nature of the test contributed to the results, and therefore, designed and administered curriculum-based tests of mathematics and literacy attainment in Study 2.

Method

Participants. A total of 207 children (112 boys) were administered the SRC (with literacy) soon after they were enrolled in Grade 1 (G1 Fall) in the local primary schools in the 2007-2008 academic year. However, data from two girls (from the control group) were excluded from the analyses because of the girls' significantly older ages. Parent/guardian interviews indicated that among the 205 children, 185 had attended ECE programs the previous year, and the preschool programs attended by 80 of these children had been observed in the previous academic year (i.e., prior to their enrollment in Grade 1). We included these 80 children and randomly selected another 127 children from the Grade 1 classes in 10 schools in ABC County. Among these children, 20 had no prior preschool experience (control group), and seven dropped out of the study. However, there were no differences in the G1 Fall literacy and mathematics attainment of children in the control group who completed the G1 Summer assessment and those who dropped out. As in Study 1, none of the children recruited in Study 2 transferred to a different type of

preschool programs before entering primary school. All schools used Putonghua, the spoken form of Mandarin Chinese, as the language of instruction.

Only 170 children (89 boys) completed the achievement tests at the end of Grade 1 (Summer). Table 3 provides demographic information for participating children at the beginning of Grade 1. Children in the sitting-in and no preschool experience groups were older than the other children at the beginning of Grade 1, F (3, 201) = 10.06, $p < .001$, $\eta_p^2 = .13$. As in Study 1, parents with more education were more likely to send their children to kindergartens.

Measures. All measures were administered in Putonghua. A trained research assistant videotaped all the preschool programs and coded the observational data.

School Readiness Composite. The School Readiness Composite of the BBCS-R was used ($\alpha = .93$). The letters in the subscale of the SRC were substituted with 15 Chinese characters from the Chinese Preschool and Primary Literacy Scale (Li & Rao, 2000).

Early Childhood Environment Rating Scale-Revised Version (ECERS-R). We used the Early Childhood Environment Rating Scale-Revised Version (ECERS-R) (Harms et al., 1998) to assess the structural quality of preschool classrooms. The ECERS-R has 43 items, which are rated on a 7-point Likert scale and grouped into the following seven subscales: space and furnishings; personal care routines; language-reasoning; activities; interaction; program structure; and parents and staff. The items on meals and snacks, nap and rest arrangements, and TV or video furniture were not applicable to preschools in rural China and were not included in our assessment of the programs' structural quality, and the remaining 38 items in the ECERS-R were used ($\alpha = .96$). The second author assessed the structural quality of the kindergarten class, one randomly selected separate pre-primary class, and one randomly selected Grade 1 class based on the photos and video-clips of those classes to determine the inter-rater reliability. The Kappa

coefficient for the ECERS-R was = .81 and inter-observer agreement was 91%.

Early Childhood Environment Rating Scale Extension (ECERS-E). The Early Childhood Environment Rating Scale (ECERS-E) (Sylva, Wiltshire, & Taggart, 2003) was used to evaluate the learning environment in these preschool programs. A 7-point Likert scale was also used to assess the learning environment in terms of literacy, mathematics, science, and diversity (α = .88). Since the item on race equity was not relevant, it was omitted. The second author assessed the learning environment of the kindergarten class, one randomly selected separate pre-primary class, and one randomly selected Grade 1 class based on video-clips of those classes to establish the inter-rater reliability. The Kappa coefficient for the ECERS-E was .83 and inter-observer agreement was 92%.

Early Childhood Classroom Observation Measure (ECCOM). The Early Childhood Classroom Observation Measure (ECCOM) (Stipek & Byler, 2004) was used to evaluate dynamic teaching processes in different preschool programs. The ECCOM consists of three parts and can be used to obtain information on the nature and quality of instruction, classroom management, and the social climate of the class. Responses were rated on a 5-point Likert scale according to the extent to which the teaching activities met the criteria of best practices (Column A in the ECCOM) was assessed (α = .93). The second author independently coded one randomly selected teaching episode from each of the three different programs to assess inter-rater reliability. The Kappa coefficient for the ECCOM was = .69 and the inter-observer agreement was 88%.

Mathematics and literacy tests. In Study 1, we used students' grades in tests designed by the local educational authorities as indicators of children's academic attainment. Because the two final examinations differed in content, it was not possible to determine the gains made by children over the period. Therefore, we developed and used the same test at the end of the two

semesters in Study 2. Our tests were also based on state-issued *Primary School Curriculum Guide in Literacy (tentative)* (Ministry of Education, 2000) and *Primary School Curriculum Guide in Mathematics (tentative)* (Ministry of Education, 2002) and modified based on Chinese early childhood curriculum specialists' suggestions. It was assumed that children would find it difficult to complete the two tests accurately at the beginning of Grade 1 (G1 Fall), but they should be able to do so by the end of Grade 1 (G1 Summer). Four subtests of pronunciation (37 items; for example, children were requested to choose the correct vowels for a picture depicting a specific word and indicate the tone of this word) (α = .91 and .94 for G1 Fall and Summer assessments, respectively), writing characters (23 items; for example, children were requested to write down the Chinese characters in Pinyin) (α = .91 and .71 for G1 Fall and Summer assessments, respectively), word composition (24 items; for example, children were asked to compare similar characters and choose the appropriate ones to form a word) (α = .96 and .94 for G1 Fall and Summer assessments, respectively), and sentence comprehension (eight items; for example, children were asked to complete a sentence by adding a predicate) (α =.83 for both G1 Fall and Summer assessments) comprised the literacy test. The mathematics test included three subtests: counting (24 items; for example, children were asked to count the number of monkeys in a picture) (α = .86 for G1 Fall and Summer assessments), comparison (18 items; for example, children were asked to compare the quantity of two sets of objects) (α = .82 and .74 for G1 Fall and Summer assessments, respectively), and computation (26 items; for example, children were required to follow directions shown in a picture such as adding 2+3) (α =.90 and .85 for G1 Fall and Summer assessments, respectively).

Procedure. With the exception of one separate pre-primary class and one Grade 1 class which had "sitting-in" children, all preschool programs involved in Study 1 (one kindergarten,

four separate pre-primary classes and five classes with “sitting-in” children) were observed to evaluate the quality of the classroom learning environment. A graduate student in early childhood education in China spent at least three sessions in each class and formally assessed the 10 preschool programs (one kindergarten, four separate pre-primary classes, and five Grade 1 classes with “sitting-in” children) using the ECERS-R and ECERS-E. The ECCOM was used to evaluate the learning activities in different preschool programs. Literacy lessons, mathematics lessons, play, and outdoor activities were videotaped to assess inter-observer reliability. A total of 22 teaching episodes were videotaped in different preschool programs, and 13 of these episodes (five, four, and four from the kindergarten, separate pre-primary and Grade 1 classes, respectively) were analyzed, including at least one mathematics and one language class and at least one of the following: music, handcrafts, outdoor play, and games in each type of ECE program. The mean length of these episodes was 32.4 minutes (range: 15 to 56 minutes).

Again, trained research assistants who were blind to children’s preschool experience administered the SRC (with literacy) of the BBCS-R soon after children were officially enrolled in Grade 1. The mathematics and literacy attainment tests were both group-based tests. Children in the same class were administered the tests together at the beginning (G1 Fall) and again at the end of Grade 1 (G1 Summer). Parents or guardians were also interviewed, in individual sessions, after school hours to obtain information about the family and children’s preschool experiences before Grade 1.

Results

Ten of the 11 teachers in the kindergarten were professionally qualified. In contrast, teachers in the separate pre-primary and Grade 1 classes had no professional training in ECE. Apart from two teachers who had graduated from senior high school, all the teachers in the

Grade 1 classes were qualified to teach in primary school. There were 188 children and nine teachers in three classes in the kindergarten. In the class we observed, there were 68 children and two teachers which represents a teacher-child ratio of 1:34. The class sizes of the separate pre-primary classes ranged from 49 to 76 children and the teacher-child ratios ranged from 1:26 to 1:76. The class sizes of the Grade 1 classes ranged from 26 to 47 but the number of children in the Grade 1 classes includes both the preschool and Grade 1 students. The teacher-child ratio ranged from 1:21 to 1:47.

As noted earlier, there was only one kindergarten in the county, and so only one kindergarten class was assessed. We also evaluated four separate pre-primary classes and five Grade 1 classes. As we observed only one kindergarten class, we could not apply statistical tests to compare the varying types of provision. Therefore, we only present descriptive statistics for the summary scores of the ECERS-R, ECERS-E, and ECCOM in Table 4. The kindergarten class was rated the highest of all programs on the three measures, indicating that it provided a relatively better learning environment for children than the other two types of preschool programs. The separate pre-primary classes received relatively higher scores in the ECERS-R and ECCOM than the Grade 1 classes, but the ratings of the two types of pre-primary classes were quite similar. These results supported our hypothesis that separate pre-primary classes might provide a learning environment more appropriate for preschool children than the Grade 1 classes. Since the major function of the Grade 1 teacher was to instruct Grade 1 children, the physical environment in these classrooms was more appropriate for primary school students than for preschoolers as children in these classes were less likely to receive individual guidance or attention from teachers. Both the separate pre-primary and Grade 1 classes adopted the Grade 1 syllabus and focused more on the acquisition of the corresponding academic skills.

Preschool experience, school readiness and achievement. Since children's ages differed significantly across groups in Study 2, we added age as a covariate in the following analyses. An ANCOVA with maternal education and child's age as covariates and children's performance in the SRC as the dependent variable yielded a significant main effect of preschool experiences on children's school readiness skills, F (3, 199) = 29.22, $p < .001$, $\eta_p^2 = .31$. Post-hoc analyses with the Tukey HSD procedure showed that the kindergarten group did better than the three other groups and that the separate pre-primary group had significantly higher SRC (with literacy) scores than the sitting-in and no preschool experience groups. Inconsistent with the findings from Study 1, children who "sat in" Grade 1 class before formally entering primary school had significantly higher SRC scores than those without any preschool experiences in Study 2 (Kindergarten: *adjusted mean* = 62.75, *SE* = 1.65; separate pre-primary class: *adjusted mean* = 51.33, *SE* = 1.61; sitting-in group: *adjusted mean* = 44.89, *SE* = 1.64; no preschool experience: *adjusted mean* = 33.83, *SE* = 2.95).

Controlling for maternal education and children's age, we also conducted separate repeated-measures ANCOVAs with preschool experience as the independent variable and children's mathematics or literacy achievement at G1 Fall and Summer as dependent variables. The Preschool Experience $\times$ Time interaction was significant for both children's literacy and mathematics achievement (literacy: *Wilk's* $\lambda = .91$, F (3, 164) = 5.20, $p < .01$, $\eta_p^2 = .09$; mathematics: *Wilk's* $\lambda = .82$, F (3, 164) = 12.16, $p < .001$, $\eta_p^2 = .18$). Further the main effects of preschool experience were significant for both children's literacy and mathematics achievement (literacy: F (3, 164) = 9.85, $p < .001$, $\eta_p^2 = .15$; mathematics: F (3, 164) = 3.91, $p < .01$, $\eta_p^2 = .07$) and time were significant for children's literacy achievement (*Wilk's* $\lambda = .97$, F (3, 164) = 5.19, $p < .05$, $\eta_p^2 = .03$).

We focused our analyses on the decomposition of the Preschool Experience × Time interaction for both literacy and mathematics achievement. Preschool experience was significant for children's literacy attainment at both G1 Fall and Summer (G1 Fall: F (3, 164) = 12.17, p < .001, η_p^2 = .18; G1 Summer: F (3, 164) = 5.83, p < .01, η_p^2 = .10). As indicated in Figure 3, children who had attended separate pre-primary classes performed significantly better than other children in the literacy test at the beginning of Grade 1 (G1 Fall). However, children from the kindergarten group showed greater gains than other children: they, together with children from the separate pre-primary group, performed significantly better than children sitting in the Grade 1 classes or without any preschool experiences in the G1 Summer literacy test.

There were no significant group differences in children's G1 Fall mathematics attainment. At the end of Grade 1 (G1 Summer), children from the kindergarten group had significantly higher mathematics achievement than the other three groups (F (3, 164) = 9.74, p < .001, η_p^2 = .15). Children who had attended either separate pre-primary or Grade 1 classes performed better than children who did not have any preschool experiences before entering Grade 1 (see Figure 4).

General Discussion

This research examined the relationships among type of preschool experience, the nature of children's early learning experiences, and rural Chinese children's early academic attainment. In both Study 1 and Study 2, we assessed children's school preparedness and their mathematics and literacy attainment during and at the end of Grade 1. We assumed that children with developmentally appropriate preschool experiences would show better early achievement than those with less age appropriate or no preschool experience.

School readiness. Consistent with our predictions, in both Study 1 and Study 2, the

kindergarten and separate pre-primary groups showed significantly better school readiness than children who had either sat in Grade 1 classes or who had no preschool experience. Further, children in the kindergarten group performed significantly better on the school readiness test than those in the separate pre-primary group. The kindergarten focused on promoting children's interest in learning and the acquisition of basic concepts, and this may explain why children from kindergartens had the highest school readiness score. Children from the separate and sitting-in groups also learnt basic concepts to varying extents, and both these groups did significantly better than children with no preschool experience on the SRC (with literacy) in Study 2. However, there were no differences between children sitting in Grade 1 classes and those without preschool experiences in the SRC (without literacy) in Study 1. This may be due to the exclusion of literacy concepts in the SRC in Study 1. Researchers have pointed out that ECE experiences are important for children's language and cognitive development (NICHD, 2000b), and our findings further suggest that sitting in Grade 1 classes may benefit children's language development, thereby enhancing their school readiness. Our findings are also consistent with studies conducted in other Asian countries, which have shown that preschool experience is correlated with children's school preparedness (e.g., Aboud, 2006; Rao & Pearson, 2007).

Achievement. As noted earlier, we obtained information from school records to determine children's early literacy and mathematics attainment in Study 1. But in Study 2, we constructed and administered more reliable curriculum-based assessments than those used in Study 1. Hence we focus on the results from Study 2.

We predicted that type of preschool experience would be more strongly associated with children's performance at the end of Grade 1 than at the start of Grade 1. The kindergarten group did not show significantly higher literacy or mathematics attainment than the separate

pre-primary and sitting-in groups in the Fall. This is not surprising as the kindergarten and the separate pre-primary classes do not focus on formal mathematical knowledge, which was assessed in the Fall test. However, by the end of Grade 1 (Summer) the kindergarten group showed better mathematics attainment than all groups and higher literacy attainment than children in the sitting-in and no preschool experience groups. This supports our speculation that kindergartens offer distinctive benefits for children's early development. The more positive approaches to learning and attitudes acquired in kindergartens (Katz & Chard, 2000) might help children adjust better to Grade 1 and promote their interest and achievement in mathematics.

Children from the separate pre-primary classes had significantly higher literacy scores in the Fall than the other groups, and we assume that this is a function of the kind of teaching they received. Research has found that children who are enrolled in didactic early child education programs have significantly higher scores in tests of letters and reading achievement than those in child-centered programs (Stipek, Feiler, Daniels, & Milburn, 1995). This may be why the children from separate pre-primary classes did better on literacy tests than those from the more developmentally appropriate kindergartens. In addition, the relatively higher performance in the literacy test of the separate pre-primary class group compared to that of the sitting-in group may reflect the influence of the more individualized instruction the former group received.

Comparisons between children sitting in the Grade 1 classes (sitting-in group) and those without any preschool experiences are particularly informative as the existence of this type of preschool education is not formally acknowledged in policy documents and is not endorsed by early childhood experts in China. However, many principals and teachers of primary schools in rural areas believe that where no other provision exists, exposure to the formal primary school environment may help prevent school drop-out and help children from ethnic minorities become

familiar with Putonghua, which is the language of instruction in schools. Further, educators believed that some exposure to a formal school setting may help children develop the emotional and behavioral self-regulation skills that are a prerequisite for classroom learning. However, we did not find any differences between children sitting in Grade 1 classes and those without any preschool experiences in performance on both the Fall and Summer literacy tests. This suggests that merely sitting in a Grade 1 class is not sufficient for children's literacy development: individualized and age-appropriate activities are necessary. While there were no differences between the two groups in Fall mathematics attainment, there were significant differences between the two groups in mathematics achievement at the end of the year. Children seemed to benefit from sitting in Grade 1 classes where mathematics was taught. These findings point to the importance of providing age-appropriate learning experiences for young children. Although sitting in Grade 1 classes during the preschool years may be helpful for children's adaptation to school, its benefits for children's learning are questionable.

Observations of preschool programs. Study 2 examined the nature of early learning experiences in different types of ECE programs. Taken together, results from the ECERS-R, ECERS-E and ECCOM suggest that the preschool programs in rural China provide a relatively low-quality learning environment compared to reports of the quality of urban kindergartens (Corter et al., 2006). However, in keeping with our predictions, teachers in the rural kindergarten provided a more child-friendly classroom climate, had better management skills, and showed higher instructional quality than teachers in the other programs. They provided more activities which promoted student engagement and responsibility for learning and had clearer instructional scripts for teaching concepts than teachers in other preschool classes. Both kindergarten and separate pre-primary class teachers provided more activities relevant to children's experiences

than the Grade 1 teachers, and there were noticeable differences in classroom climate between separate pre-primary and Grade 1 classes.

While our findings do not directly shed light on the issue of whether preschool education should be provided to all children or whether only vulnerable children should be targeted, they, along with the extant research literature, suggest that preschool services are beneficial for poor rural children in China. Our findings also suggest that these services should be appropriate for their age. We did not compare the school readiness and attainment of our sample to those of children in urban areas, but based on our observations of early childhood education in China, we are sure that urban children who attend kindergartens of even a mediocre quality would show higher attainment than children in our sample.

Implications

Our results have implications for scaling up ECE programs in rural China. Our observational data substantiate concerns which have been expressed about the quality of existing ECE programs in rural China. The relatively low quality of the learning environments in separate pre-primary classes and Grade 1 classes (for preschool-aged children) is particularly worrisome. The space and learning resources available were limited in some of the separate pre-primary classes. The high teacher-child ratio was also a common problem in all the preschool programs we observed. There were at least 49 children and only one teacher in each separate pre-primary class. In the Grade 1 classes, teachers had to manage both the primary- and the preschool-aged children, and the learning needs of preschoolers tended to be neglected. Teachers' limited professional training in ECE, especially in the case of those teachers in separate pre-primary and Grade 1 classes, also hindered age-appropriate practices for young children in these programs. Efforts should be made to address these issues.

There were variations in the children's attainment depending on the type of program the children had experienced, which raises the question of what type of ECE programs should be scaled up in rural China. Several factors associated with rural education in China and the nature of different programs must be considered. Children in the kindergarten groups did not differ from those sitting in Grade 1 classes and those without any preschool experiences in attainment tests conducted in the Fall, but they did significantly better than them by the end of Grade 1 in Study 2. This may be due to the cumulative advantages offered by kindergarten programs and because the benefits are evident at a later point in development (sleeper effect). It should also be noted that the class sizes in kindergartens in rural China are considerably larger than those in developed countries, yet, kindergarten attendance was related to better early attainment. These results suggest that kindergarten programs should be expanded in rural areas. While the children from the kindergarten performed better than the other children on most of our measures, this form of preschool program is more resource-intensive than other ECE programs, and there are currently relatively few kindergartens in rural China.

We realize that it may be difficult to provide kindergartens in more remote rural areas. Separate pre-primary classes and having children sitting in Grade 1 classes are common in remote areas because they are affiliated with primary schools and as such, do not involve a great deal of expenditure. Therefore, they assume important roles in providing ECE, and it may be more realistic to encourage the establishment of separate pre-primary classes in remote areas and to provide schools with more technical and professional support in order to establish a more child-friendly environment. Despite the benefits of sitting in Grade 1 classes over not attending any form of ECE program on mathematics attainment, children in these classes may not receive adequate teacher attention, and such programs use approaches to ECE that are not consistent

with state-issued curriculum guidelines. These classes may be converted into separate pre-primary classes by re-allocating existing resources. Such a conversion would at least improve the quality of learning experiences offered to children. If this were to happen, teachers would need more professional support and training. It should be noted that many international organizations such as the World Bank and UNICEF have provided valuable support to ECE programs in rural China over the past several years. This type of technical and financial assistance is necessary to scale up ECE programs in rural China in an appropriate manner.

While this study contributes to the very limited literature on preschool effectiveness in the developing world, it has several limitations related to research design, sampling methods, assessment of preschool quality, and approach to analyses. First, given the nature of the research design, we cannot draw causal conclusions based on the results. Second, the study was conducted in only one rural area of China and our sample size was relatively small, with the numbers of participants in the groups varying from 13 to 64 children. There may also have been selection bias in our sample and we did not comprehensively examine children's pre-existing differences related to factors not included in the analyses. For example, although all children came from low-SES families, differences in parents' beliefs and practices may have contributed to differences among children at the beginning of the study. Hence our comparisons across groups are liked to be biased. Third, we only systematically assessed the quality of one kindergarten, four separate pre-primary programs, and five Grade 1 classes which included preschool-aged children. Since the preschool classes of only 80 of the 205 children in Study 2 were observed, we were therefore unable to correlate preschool observational data with child outcomes. Further, the measures used to evaluate the quality of preschool programs, i.e., the ECERS-E, ECERS-R, and ECCOM, may not have been appropriate for Grade 1 classes. Fourth,

we did not account for the nesting of children in classrooms. Clearly, further studies with larger samples, more robust research designs and more powerful approaches to data analyses are needed.

Despite these limitations, this is the first study to examine systematically the relationships among children's preschool experiences, the nature of preschool experiences in different forms of preschool programs, and children's attainment and in rural China. These data are a first step in providing research evidence for policy decision making in the world's most populous country. It is hoped that these findings improve our understanding of the relationship between preschool experiences and child development, contribute to further program development, and provide empirical data for evidence-based ECE practices and scientific policy decision making in rural China and beyond.

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Table 1

Comparisons among Three Types of Preschool Programs in Rural China

	Kindergarten	Separate pre-primary class	Grade 1 class (Sitting-in group)
Management	Educational authorities or communities	Primary schools	Primary schools
Ages of children served	3-5/6	5-6	3-7
Location of program	Independent premises in larger towns	Separate classes in primary schools	Grade 1 classrooms in primary schools
Education of caregiver	Basic training in ECE	Typically no formal teaching qualifications in ECE	Typically having a formal qualification for teaching primary school children but not for those below six
Type of instruction / focus of care	Play-based methods are typically used and usually have child appropriate furnishings, toys, and educational materials.	Elements of the Grade 1 syllabus form part of the pre-primary curriculum. Children sometimes have time for free play, but few toys are provided.	Grade 1 syllabus
Daily duration of service	Full day	Full day	Full day

Table 2

Participants Characteristics in Study 1

	Kindergarten	Separate pre-primary class	Grade 1 class (Sitting-in group)	No preschool experiences	*F*, *t* or χ^2
Number of children	53 $_{a}$	64 $_{a}$	33 $_{b}$	15 $_{c}$	34.25*
Child's age (in months) *M (SD)*	85.98 (3.80)	84.66 (6.12)	87.66 (5.52)	86.97 (4.94)	2.63
Child's gender (% Male)	56.6	51.6	42.4	40	2.34
Mother's education (years in school) *M (SD)*	4.57 (3.21) $_{a}$	2.89 (3.15) $_{b}$	1.68 (2.02) $_{c}$	1.67 (2.53) $_{c}$	8.33*
SRC (G1 Fall) *Adjusted Mean (SD, SE)*	58.15 (6.24, 1.40) $_{a}$	47.40 (8.62, 1.22) $_{b}$	37.54 (14.01, 1.74)$_{c}$	37.44 (14.15, 2.54)$_{c}$	37.72*
Literacy attainment (G1 Winter) *Adjusted Mean (SD, SE)*	54.35 (23.30, 3.26) $_{a}$	44.30 (23.65, 2.85) $_{ab}$	33.96 (20.51, 4.06) $_{b}$	32.71 (25.90, 5.95) $_{b}$	6.06*
Mathematics attainment (G1 Winter) *Adjusted Mean*	54.16 (25.38, 3.50) $_{a}$	39.36 (24.26, 3.06) $_{b}$	28.51 (24.77, 4.35) $_{b}$	36.83 (24.70, 6.38) $_{ab}$	7.15*

(SD, SE)					
Literacy attainment					
(G1 Summer)	66.68	63.11	58.53	60.51	.81
Adjusted Mean	(24.15, 3.21) $_{a}$	(26.01, 2.73) $_{a}$	(29.41, 3.96) $_{a}$	(30.46, 5.75) $_{a}$	
(SD, SE)					
Mathematics attainment					
(G1 Summer)	66.93	65.34	62.18	54.53	1.80
Adjusted Mean	(20.20, 2.71) $_{a}$	(23.49, 2.28) $_{a}$	(26.35, 2.71) $_{a}$	(25.54, 4.76) $_{a}$	
(SD,SE)					

Note. * $p < .05$. Means sharing a common subscript are not statistically significant at $\alpha = .05$ according to the Tukey HSD procedure.

Table 3

Participants Characteristics in Study 2

	Kindergarten	Separate pre-primary class	Grade 1 class (Sitting-in group)	No preschool experiences	*F*, *t* or χ^2
Participants in the G1 Fall school readiness test in Study 2					
Number of children	62	62	61	20	
Child's age (in months) *M (SD)*	85.82 (3.70) $_a$	85.73 (2.67) $_a$	88.27 (4.73) $_b$	90.34 (6.37) $_b$	10.06*
Child's gender (% Male)	53.2	51.6	62.3	45.0	2.47
Mother's education (years in school) *M (SD)*	4.34 (3.21) $_a$	3.38 (3.08) $_{ab}$	2.49 (2.09) $_{bc}$	1.43 (1.40) $_c$	7.67*
SRC *Adjusted Mean (SD, SE)*	62.75 (8.65, 1.65) $_a$	51.33 (14.15, 1.61) $_b$	44.89 (14.61, 1.64) $_c$	33.83 (12.19, 2.95) $_d$	29.22***
Participants in the G1 Fall and Summer academic assessments in Study 2					
Number of children	49	61	47	13	
Child's age (in months) *M (SD)*	86.28 (3.78) $_a$	85.80 (2.72) $_a$	88.69 (4.67) $_b$	90.22 (9.49) $_b$	6.70*
Child's gender (% Male)	48.0	52.5	59.6	42.9	1.87
Mother's education (years in school)	4.68 (3.30) $_a$	3.41 (3.04) $_{ab}$	2.28 (2.27) $_b$	1.47 (1.45) $_b$	7.85*

M (SD)					
Literacy attainment					
(G1 Fall)	22.74	37.02	20.59	16.97	12.17***
Adjusted Mean (SD, SE)	(9.77, 2.37) $_{a}$	(19.83, 2.13) $_{b}$	(16.73, 2.44) $_{a}$	(14.26, 4.47) $_{a}$	
Mathematics attainment					
(G1 Fall)	22.46	26.44	23.89	18.20	2.14
Adjusted Mean (SD, SE)	(7.21, 1.74) $_{a}$	(12.57, 1.56) $_{a}$	(13.99, 1.79) $_{a}$	(14.38, 3.28) $_{a}$	
Literacy attainment					
(G1 Summer)	65.99	64.59	51.48	47.69	5.83***
Adjusted Mean (SD, SE)	(16.31, 2.94) $_{a}$	(21.10, 2.65) $_{a}$	(21.31, 3.02) $_{b}$	(22.67, 5.55) $_{b}$	
Mathematics attainment					
(G1 Summer)	50.67	44.71	42.92	33.57	9.74***
Adjusted Mean (SD, SE)	(7.04, 1.51) $_{a}$	(11.26, 1.36) $_{b}$	(10.78, 1.56) $_{b}$	(13.58, 2.86) $_{c}$	

Note. * $p < .05$. Means sharing a common subscript are not statistically significant at $\alpha = .05$ according to the Tukey HSD procedure.

Table 4

Observed Preschool Quality in Study 2

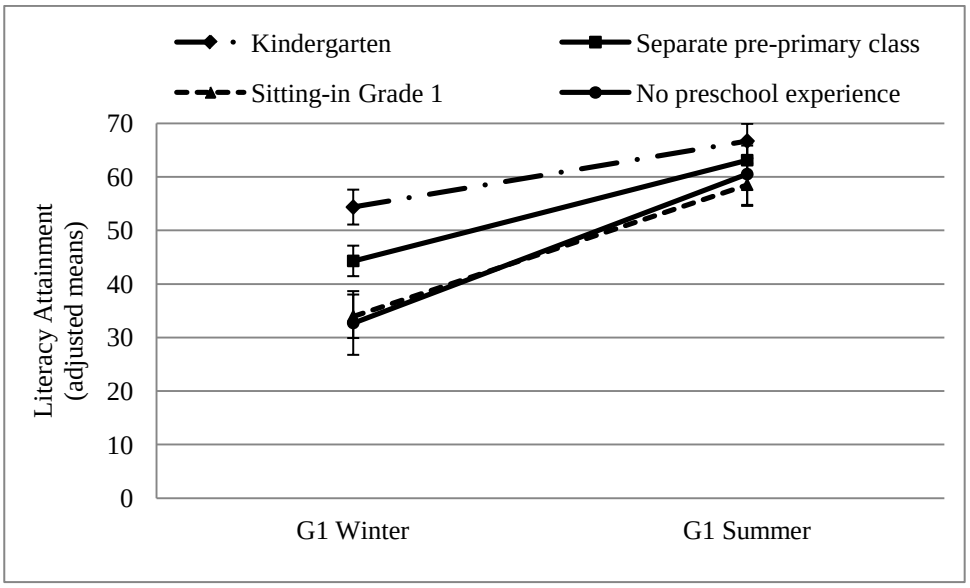
	Kindergarten *M (SD)* *(Range)* *n* = 1 class, 5 teaching episodes	Separate pre-primary class *M (SD)* *(Range)* *n* = 4 classes; 4 teaching episodes	Grade 1 class (Sitting-in group) *M (SD)* *(Range)* *n* = 5 classes; 4 teaching episodes
ECERS-R [1]	18.45	9.70 (1.71) (7.25 - 10.95)	7.94 (.97) (7.25 - 9.63)
ECERS-E[1]	8.17	5.52 (.13) (5.33 - 5.58)	5.45 (.16) (5.33 - 5.67)
ECCOM[2]	9.34 (2.36) (5.88 - 12.42)	6.01 (.27) (5.73 - 6.38)	4.59 (.70) (4.03 - 5.58)

[1] Results were based on the observations of the general environment in each classroom.

[2] Results were based on the teaching episodes videotaped in these classrooms.

Figure 1

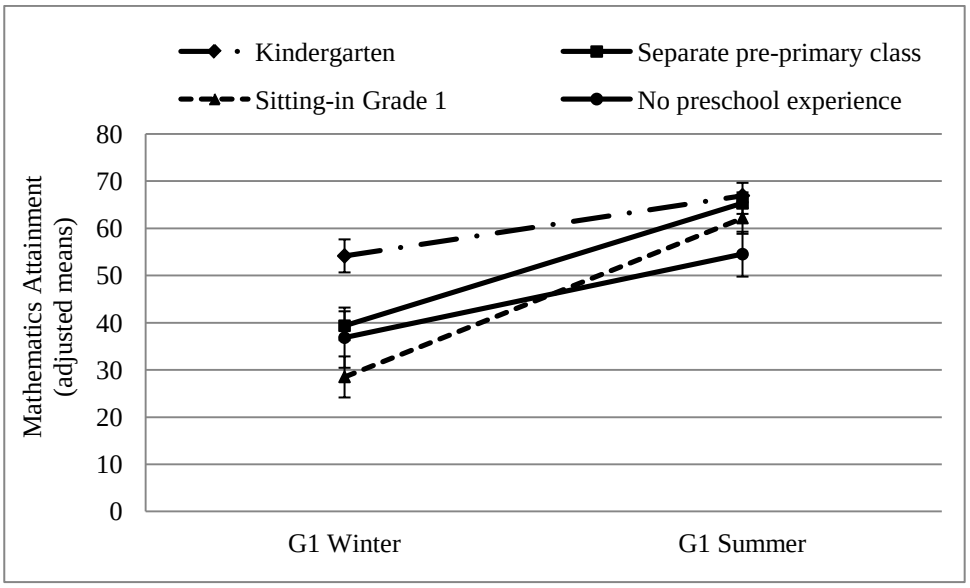
Literacy attainment at the G1 Winter and Summer assessments for children with different preschool experiences in Study 1



Note. Different tests were used in G1 Winter and G1 Summer.

Figure 2

Mathematics attainment at the G1 Winter and Summer assessments for children with different preschool experiences in Study 1



Note. Different tests were used in G1 Winter and G1 Summer.

Figure 3

Literacy attainment at the G1 Fall and Summer assessments for children with different preschool experiences in Study 2

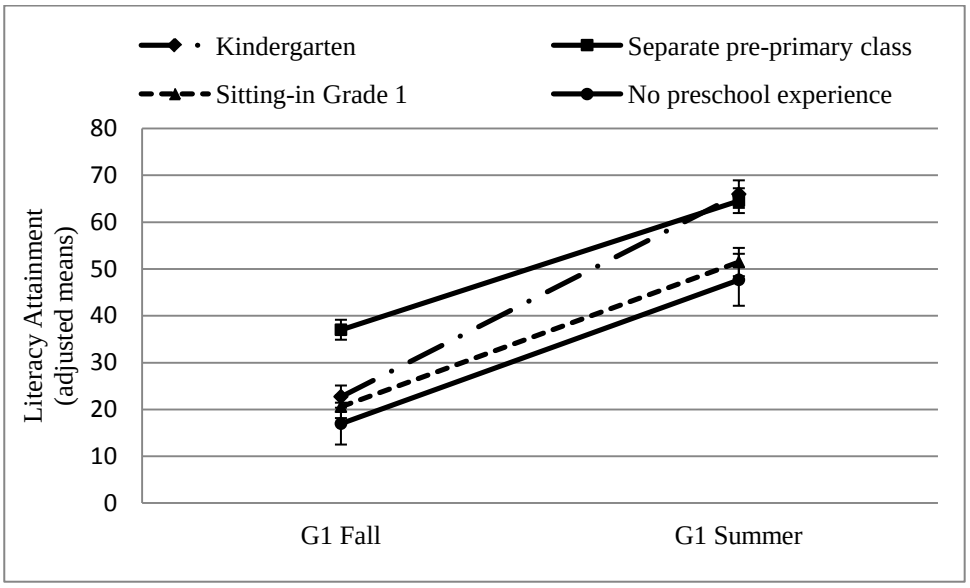


Figure 4

Mathematics attainment at the G1 Fall and Summer assessments for children with different preschool experiences in Study 2