Abstract

In China, millions of young children who speak a minority language acquire Mandarin Chinese as their second language when they enter bilingual kindergarten or elementary school. Since most ethnic minority children living in China come from low-socioeconomic status (SES) families, learning Mandarin as a second language is a crucial milestone for them. However, little research has been conducted to explore how to support the bilingual development of young minority children in China. This study evaluated the efficacy of a randomized controlled book-reading intervention held in Xinjiang Province, a unique Uyghur-Mandarin Chinese bilingual region with the lowest GDP of any Chinese province. The classroom-based book-reading intervention (hereafter, the Xinjiang Project, or the XJP) included a special focus on (1) Chinese-Uyghur bilingual picture books, (b) curriculum of vocabulary instruction, and (c) teacher training. We recruited 256 Uyghur 4–5-year-old children (96 four-year-olds and 160 five-year-olds) from 31 classes in 12 kindergartens from two cities (Urumqi and Turpan) and randomly assigned 16 classes (134 children) to the experiment group and the other 15 classes to the control group, blocked by city, age and an kindergarten ranking indicator. Across the one-year intervention, we collected three waves of Chinese and Uyghur vocabulary data. We used an individual growth modeling framework employing generalized linear mixed models and found that the intervention led to a more rapid development of Chinese receptive vocabulary (effect size = 0.68) and Uyghur expressive vocabulary (effect size = 0.38). This study shows that well-designed book-reading programs can benefit language minority children by supporting the development of both home and school languages simultaneously. The implications for bilingual education policy-making in China are discussed.

Keywords: Book reading, randomized controlled trial, Uyghur-Chinese; language minority children, vocabulary intervention

The Efficacy of a Book Reading Intervention on Vocabulary Development of Young Uyghur Children: A Randomized Controlled Trial

China has a great diversity of language groups. Millions of young children who speak a minority language acquire Mandarin Chinese as their second language when they start school. Most minority groups in China reside in poverty-stricken mountain areas, and many minority children living in China come from low-SES families. Accordingly, learning Chinese as a second language is a crucial milestone in their path to academic success. However, little empirical research has been conducted to explore how to support the bilingual development of young minority children in China.

Xinjiang Uyghur Autonomous Region (hereafter, Xinjiang) is a unique Mandarin Chinese–Uyghur bilingual area, and one of the poorest provinces in China. For ethnic minorities such as the Uyghur, knowing Mandarin Chinese is not only an advantage when it comes to getting an education but also a strength in the job market. Economic disadvantage and a lack of bilingual education resources, however, still impede the language learning of minority children. In response to the shortcomings of bilingual education in Xinjiang, China's policies over the last fifteen years have significantly expanded access to public bilingual kindergarten and preschool, such that 75 percent of all students in Xinjiang are now receiving bilingual education (Xinhua News Agency, 2015). However, studies that observe the bilingual education provided in the kindergarten classrooms of Xinjiang have raised concerns about teaching quality and educational outcomes (Sun, 2010; Zhou, Li, Du, Wang, Chen & Zhang, 2014). Moreover, most of the studies focusing on Xinjiang early bilingual education do not enter the classroom, focusing instead on discussing the outlines and contents of the education policies. Evidence from experimental research is needed to understand how to improve the quality of early bilingual education in Xinjiang and aid in the development of minority children's Mandarin language skills. A class-based intervention that provides opportunities for young children to read and discuss picture books is a robust way to advance children’s language ability (See review from Wasik, Hinderman & Snell, 2016). Studies show that well-designed picture-book–based interventions in kindergartens help English monolingual and English-Spanish bilingual children improve vocabulary size and listening comprehension (August & Shanahan, 2006). However, whether a book-reading intervention will also improve the vocabulary acquisition of children in a Mandarin Chinese–Uyghur bilingual kindergarten—in either language—is still unclear. This study, as the first randomized controlled intervention focusing on young Uyghur children’s language development, explores the causal impacts of a classroom-based book-reading intervention on

their receptive and expressive vocabulary development in Uyghur and Mandarin Chinese. Considering the unique language, culture, and bilingual education policy context in Xinjiang, this study contributes to the current literature in two ways. First, this study causally links the book-reading intervention and Uyghur children's vocabulary growth, which will be valuable for bilingual education policy-making. Second, the study not only analyzes children's vocabulary development in Chinese, which is the academic language of the classroom, but also calculates the influence of the intervention on children's Uyghur language development. The effects on the children's school and family languages will lead to a deeper understanding of how this type of intervention may or may not be effective in a bilingual context, and could lead to more research in other similar settings.

Helping young children improve vocabulary size: Evidence from previous studies

The challenge of vocabulary

Vocabulary knowledge is a critical component of oral language and literacy development, and one of the most significant predictors of children's future academic and life success (De Temple & Snow, 2003; Hart & Risley, 1995; Huttenlocher et al., 1991; Snow, Burns & Griffin, 1998). For young children, learning the meaning of words is a foundational skill for reading and writing development (Muter, Hulme, Snowling, & Stevenson, 2004; Sénéchal, Ouellette, & Rodney, 2006). Researchers have found, in studies that control for gender, birth order, ethnicity, and intelligence, that the rate of vocabulary growth from ages four to six predicts later reading and literacy achievement (Lee, 2011; McKeown, 2012). The vocabulary skills of preschool children are essential for school readiness and play a critical role in students' academic success (Cunningham & Stanovich, 1997; Marchman & Fernald, 2008; Morgan et al., 2015; Walley, 1993).

On average, children from low-SES families arrive at school with less vocabulary knowledge than children from high-SES families (Hoff & Tian, 2005, Rydland, Aukrust, & Lawrence, 2013). Children living in low-SES families experience less maternal speech, exposure to print materials, and language use (including oral language and gestures), as well as fewer enrichment opportunities (Dickinson & Tabors, 2001; Hoff, 2003; Rowe & Goldin-Meadow, 2009; Turkheimer, Haley, Waldron, D'Onofrio, & Gottesman, 2003). Many young low-SES children face challenges when they enter school with comparatively limited vocabulary knowledge (Hart & Risley, 1995; Snow et al., 1998). Recent research has found that language minority (LM) children also face learning barriers that hamper swift second language (L2) vocabulary learning rates (Tabors & Snow, 2003). LM children's global L2 language

skills may lag behind those of their monolingual peers (August & Shanahan, 2006; Lesaux, Rupp, & Siegel, 2007; Patterson, 2004; Reese, Sparks, & Leyva, 2010; Uccelli & Páez, 2007).

Intervention on vocabulary growth

Well-designed interventions are required to help LM children improve vocabulary development at an early age in preparation to overcome the language and academic barriers in their future. A meta-analysis reveals that the effect size of a vocabulary intervention in preschool and kindergarten is relatively large; on average, such interventions can help young children score nearly one standard deviation higher than controls on measures of target words (Marulis & Neuman, 2010). Many interventions focused on improving LM kindergarten students' vocabulary that have proven to be effective have the following features: (1) using picture books to increase children's exposures to words (Loftus, Coyne, McCoach, Zipoli, & Pullen, 2010; Silverman & Hines, 2009); (2) preparing teachers to improve the quality of vocabulary instruction (Cheung & Slavin, 2005; Kohnert, Yim, Nett, Kan & Duran, 2005); and (3) designing new curriculum that encourages children to discuss and use the target words (Silverman, 2007; Ruston & Schwanenflugel, 2010).

Using picture books. Conducting shared reading activities in the classroom with picture books has proven an efficient and reliable method to help young children develop language proficiency. The effect size varies from 0.1 to 1.0 standard deviation (Wasik, Hindman & Snell, 2016). Well-designed experiments show that picture books provide valuable opportunities for young children to learn unfamiliar yet essential vocabulary that they may not encounter in daily life (Mol, Bus & de Jong, 2009; Weizman & Snow, 2001). Interventions that provide more than twenty books for the classroom, as well as instructions for teachers on how the use the materials (Silverman, Crandell & Carlis, 2013; Wasik, Bond & Hindman, 2006), detect a significant increase in children's receptive vocabulary.

Improving the quality of vocabulary instruction. Putting picture books in the classroom is not enough. Researchers emphasize that specific vocabulary instruction strategies are required (Snell, Hindman & Wasik, 2015). Many studies suggest two essentials that promote children's language development. First, it is crucial for the teacher to lead a discussion around the picture book (Jalongo & Sobolak, 2011). Discussion about the book potentially provides multiple exposures to the target vocabulary. Additionally, asking and answering questions about the concepts and events in the picture book may lead to a better understanding of the meaning of vocabulary. The second important method is to expand the topic of the picture book into different classroom activities—e.g. role

play, art corner or emergent writing (Hassinger-Das et al., 2016; Snell et al 2015). An integrated curriculum based on the theme of the picture book and using target words will give children opportunities to practice words in different contexts with different audiences: teachers, peers, or parents. Meanwhile, discussing the book and designing a curriculum that integrates the book are both challenges for the educators. Researchers highlight the need to prepare teachers with strategies for teaching shared book reading, leading vocabulary discussion, and developing a new curriculum (Neuman, 2011).

Complexity of minority children's first- and second-language learning outcomes

Although studies confirm that book reading in the kindergarten classroom is useful in promoting the development of children's vocabulary, the effects on children's first language (L1) and second language (L2) learning are not always consistent (Jalongo, 2000; Tabors & Snow, 2003). Typically, studies find that book-reading interventions focused on L2 lead to a faster growth on L2 (Brock et al., 2008; Mol, Bus, & de Jong, 2009; Roberts, 2008). Few interventions detect a significant difference in L1 development even if they provide bilingual books or curriculum materials (Farver, Lonigan & Eppe, 2009). There are at least three theoretical positions that have been used to explain how sequential bilinguals learn each language. The time-on-task perspective interprets language learning as a zero-sum game; time spent learning one language results in less time available to learn another (Cha & Goldenberg, 2015; Quiroz, Snow, & Zhao, 2010). According to this view, we would expect to see a negative correlation (or no correlation) between students' performance on the L1 and L2 tasks. The interdependence hypothesis emphasizes that students leverage knowledge of one language while learning another. This hypothesis predicts positive correlation between L1 and L2 measures, especially if the learner has reached a minimum competency in one of the two languages (Cummins, 1979). The socio-pragmatic view (Akhtar & Tomasello, 2000; Tomasello, 1992) emphasizes the importance of social contexts in language learning. These contexts provide semantic limitations on the possible meanings of newly encountered words. Providing L1 and L2 instructional support for sequential bilinguals may help them both leverage knowledge across languages and scaffold their ability to navigate language environments. In this sense, the socio-pragmatic hypothesis can be interpreted as an extension of the interdependence model. Constructing an environment in the kindergarten classroom in which children have access to picture books and can participate in discussion and in multiple activities related to the books has been well studied as an efficient way to improve children's vocabulary development in English-speaking populations. There is far less work on Uyghur-Chinese bilingual children. Well-designed intervention studies on Uyghur children, part of

the largest and most significant language minority group in China, are critical for researchers, teachers, and policy-makers to understand practical methods to help their language development.

Xinjiang: A unique bilingual early childhood education setting in China

Located on the northwestern border of China, neighboring Afghanistan, Tajikistan, and Mongolia, the Xinjiang Uyghur Autonomous Region is the biggest province in China. It is also the poorest. Xinjiang is the home to the Uyghur (more than 70% of the population in the Xinjiang region), a Turkic people who converted to Islam in the tenth century. Xinjiang has been subject to rapid modernization over the past decades, resulting in violence and restrictions on social and religious freedoms that have brought "China's most turbulent area" (Johnson, 2013) into the media spotlight.

Uyghur-Chinese bilingualism

Today, Xinjiang has the greatest diversity of language groups in China. Officially there are seven languages used in formal education settings and textbooks: Uyghur, Mandarin Chinese, Kazakh, Mongolian, Kyrgyz, Xibe, and Russian (Wang & Meng, 2006). Except for Xibe and Russian, these languages have television broadcasts and newspapers (Statistic Bureau of Xinjiang Uyghur Autonomous Region, 2014a). Over 53% of the population (11 million people) in Xinjiang are Uyghur people (Statistic Bureau of Xinjiang Uyghur Autonomous Region, 2014b). As one of the largest language-minority groups, Uyghur people use Uyghur, a Turkic language, as their oral and written language. For them, Uyghur is also the language of home and community in most areas of the province.

In 2009, there were over 1.3 million Uyghur children aged zero to six (National Bureau of Statistics of the People's Republic of China, 2010). They acquire Uyghur as their first language and learn Mandarin Chinese when they enter a bilingual kindergarten or elementary school. Since most Uyghur children living in Xinjiang come from low-SES families, as Xinjiang is one of the poorest regions in China, learning Chinese as a second language is a crucial milestone for them. To achieve academic success, young Uyghur children must become fluent in Chinese (reading, writing, and speaking), since most school instruction after first grade, especially in science, is in Mandarin Chinese (Li & Cai, 2012). Bilingualism is also a key economic outcome for education because being bilingual enables Uyghur young adults to pass the university entrance exam and be much more competitive for well-compensated jobs (Sun, et al., 2012). Unfortunately, little research has been conducted to determine the quality of

early childhood education in Xinjiang or to explore how to use preschools to support both Mandarin Chinese and Uyghur development.

Bilingual early childhood education in Xinjiang: Policy and practice

The national Bilingual Education Experiment. In 1999, Xinjiang launched a "Bilingual Education Experiment" (BEE). This policy requested that elementary and middle schools teach science, mathematics, and English classes in Mandarin, and other courses in Uyghur. In 2005, the Xinjiang government extended this policy to kindergartens by requesting that kindergartens teach more Mandarin (they had previously been teaching only in Uyghur), offer free lunch for Uyghur children, and offer pay incentives to teachers in bilingual kindergartens (Ma, 2008). By the end of 2014, 69.8% of Uyghur children were enrolled in BEE kindergartens (Statistic Bureau of Xinjiang, 2016), compared with 29.4% in 2006 (Ma, 2008).

Bilingual education quality. Although the number of children attending BEE kindergartens has increased remarkably, attention to the quality of the early bilingual curriculum in Xinjiang lags. The important role of Uyghur in bilingual education has long been underestimated. Neither the curriculum nor the teachers of the BEE schools are well-prepared for bilingual instruction.

The curriculum. During the early years of BEE, the curriculum and teaching in Xinjiang consisted of nothing more than immersive Chinese learning for Uyghur children. In 2009, a bilingual curriculum was introduced, with textbooks written in both Mandarin and Uyghur. But it wasn't even until 2012 that the first reference to the development of young children's home language in the national official Guidelines on Early Learning and Development occurred (China Ministry of Education, 2012). Finally, a new version of the bilingual preschool curriculum of Xinjiang formally required teachers to use both Mandarin and Uyghur in the Mandarin learning course starting in 2013.

The teachers. Although curricular materials emphasizing Uyghur are readily available, bilingual kindergarten teachers have had very few chances to develop efficient and high-quality bilingual teaching strategies. Native Chinese-speaking teachers are typically not able to speak Uyghur. Although many Uyghur bilingual kindergarten classrooms have two teachers, one Uyghur-speaking, most bilingual preschool teachers (both native Chinese or Uyghur-speaking) were instructed and trained to teach in Chinese only.

The teaching practice. According to the observations of researchers, language-learning classes in Xinjiang kindergartens emphasized simple decoding of Chinese words, Chinese character recognition, and writing, but paid

little attention to the comprehension of language and text (Sun, 2012). In a typical bilingual kindergarten classroom, there were few picture books, reading materials, or shared book reading activities, in either Mandarin Chinese or Uyghur (Zhou, Li, Du, Wang, Chen & Zhang, 2014).

The learning outcomes of children. Case studies and theoretical work focusing on the Xinjiang bilingual education system report contradictory findings. Tsung and Cruickshank (2009) observed classroom teaching in two Xinjiang primary schools and concluded that the Xinjiang bilingual school system failed to provide sufficient access for language minority children to learn Uyghur, Chinese, or a third language (English). They claimed the education *delayed* children's language learning, thereby impeding access to higher education. In contrast, Huang's (2011) case study found that preschool students' bilingual development was not delayed if they had a rich second language input (i.e., read Mandarin books and watched Mandarin television). However, according to other researchers comparing the vocabulary development of 4–6-year old monolingual Mandarin children and Mandarin-Uyghur bilingual children, on average Uyghur children scored 1.58 standard deviations lower on Chinese receptive vocabulary, and 1.87 standard deviations lower on Chinese expressive vocabulary (Li, 2013; Chen, 2014).

So far the findings do not agree on a common narrative, but it is likely that bilingual education in Xinjiang needs to be improved. Beyond these studies, there is little empirical evidence on the state of Uyghur children's bilingual learning. In the present study, we test the effectiveness of an intervention intended to support kindergarten children's development of Mandarin Chinese and Uyghur language skills through the introduction of bilingual reading materials in the context of ongoing professional development for teachers. In the literature review that follows we provide a rationale for our focus on expressive and receptive vocabulary (in L1 and L2) and then describe the materials and the procedure in the intervention.

The Xinjiang Project book reading intervention

To see if shared book reading could close the vocabulary gap between Uyghur and native Chinese-speaking children, we designed the Xinjiang Project (the XJP) intervention, which built on the successful strategies we learned from previous book reading interventions. The XJP started in May 2012 and ended in June 2013. The XJP is the first language education intervention conducted in Xinjiang kindergartens. Supported by the Ministry of Education of China, the goal of the XJP is to provide a well-structured, school-based intervention to help young Uyghur children improve their Chinese language, and especially to help them develop their productive and receptive vocabulary.

A team of experts on language acquisition theory and early language education practice (university professors and outstanding kindergarten teachers) in China collaborated with us on the design of the XJP. The team selected the picture books, wrote and edited the curriculum/teacher training materials.

Previous interventions in early-grade bilingual education helped guide the design of the XJP. Based on theories of LM children's early vocabulary acquisition, effective interventions for LM students, and the typical early childhood education environment in Xinjiang, the XJP aimed to use picture books to provide high-quality second language input, including reading and discussion. By choosing Uyghur-Chinese bilingual picture books in particular, rather than Chinese monolingual books, we sought to support children's native language vocabulary acquisition as well.

The content of the Xinjiang Project

There are three main elements of the XJP:

1. Enriching the classroom literacy environment for Uyghur students. The XJP provided each class with 10 copies of 30 different Mandarin-Uyghur picture books that included related posters and word cards. These books were chosen based on (a) recommendations from early childhood education experts, (b) the books' rich vocabulary, and (c) the presence of interesting stories or topics that can be easily discussed (e.g., music, animals, etc.).
2. Implementing a new curriculum that promotes language exposure and practice via classroom discussions. The teachers received training and lesson plans containing methods for utilizing the curriculum for 20 min of class each day. Each week, teachers introduced four topics (related to the picture books) for small-group discussion and one whole-class activity (e.g., a field trip). The key goal of the curriculum was to enable children to encounter and utilize vocabulary and then to reinforce their learning by probing with open-ended questions. The XJP gave teachers flexibility in incorporating the Project's language books into their teaching agenda.
3. Providing teachers with a thorough understanding of the theories behind the intervention and introducing practical strategies to integrate these materials and principles into their curricula (e.g., concepts of early literacy education, methods for using picture books to improve language learning, and classroom teacher-child interaction strategies). The XJP provided three types of teacher training, including a one-on-one training session in the classroom, two group meetings, and three sessions of online long-distance training.

The Current Study

The current study was designed to use longitudinal data to investigate the impact of the XJP on Uyghur children's vocabulary development. To measure the effects of this intervention, we employed a cluster randomized controlled trial (RCT) that sampled 31 Uyghur-Chinese bilingual classes from 12 public kindergartens in two cities of Xinjiang, Urumqi and Turpan. The treatment group (16 classes) received the XJP intervention while the control group (15 classes) received no intervention and maintained their existing curriculum and schedule.

By modeling the children's individual growth trajectories in Chinese and Uyghur vocabulary, measured using standardized tasks translated from Chinese to Uyghur, we addressed the following research questions:

1. Does the XJP improve Uyghur children's Chinese receptive and/or expressive vocabulary size?
    1) Do the children in the XJP with an entry age of 5 have a higher vocabulary acquisition rate than children with an entry age of 4?
    2) Do the children in the higher-ranked (Excellent) schools have a higher vocabulary acquisition rate than their lower-ranked (Normal) school counterparts?
2. Does the XJP improve Uyghur children's Uyghur receptive and/or expressive vocabulary size?
    1) Do the children in the XJP with an entry age of 5 have a higher vocabulary acquisition rate than children with an entry age of 4?
    2) Do the children in the higher-ranked (excellent) schools have a higher vocabulary acquisition rate than their lower-ranked (normal) school counterparts?

Method

Sites

Twelve public kindergartens in two cities of Xinjiang, China, agreed to participate in this study and follow the randomization condition. Eight schools were in Urumqi, the capital city of Xinjiang, which enjoys the best economic and Chinese learning environment of Xinjiang. As the largest city in Xinjiang, Urumqi has 3.5 million people, with thirty percent consisting of minority language speakers. Four schools were in Turpan, a prefectural-level city in east Xinjiang with 0.6 million people, much smaller than Urumqi. Eighty percent of the population in Turpan are minority language speakers.

Kindergartens

In Xinjiang, every public kindergarten has a ranking that indicates their education quality and directly relates to the funding from the government. The ranking standard was designed by the Commission of Education of Xinjiang (CoE). This official kindergarten ranking considered three characteristics of the kindergarten: (1) the physical environment; (2) the teacher background (e.g. education level; years of teaching experience); and (3) the teaching quality. The CoE conducts school and classroom observation and re-evaluates the ranking yearly. There were two levels of ranking in this study: excellent (the higher ranking) and normal (the lower ranking). According to classroom observation studies, excellent kindergartens are significantly different from normal kindergartens on the axes of teacher-child interaction quality (Zhang, 2013) and number of classroom activities (Wang, 2014).

It is not surprising that parents prefer to send their children to kindergartens with the "excellent" rating. For children to be enrolled in a high-ranking kindergarten, parents need to own real estate in a certain school district, or work in specific institutes (e.g. universities or state-owned enterprises). These standards distinguish children in the excellent kindergartens from other peers from lower SES backgrounds. Similar to studies in the United States that use the Free Lunch program (see review of Harwell, LeBeau, 2010) as an indicator of children's family SES, in this study, we consider the kindergarten ranking not only an indicator of education quality, but also of children's family background.

By recruiting schools, researchers individually asked the director of kindergarten if she or he would agree to participate in the intervention and follow the randomization condition. The first 12 schools who agreed were recruited. In this study, four of the eight kindergartens in Urumqi and two of the four kindergartens in Turpan had an excellent ranking. The other kindergartens had a normal ranking.

Participants

Within each kindergarten, between one and four classes joined the study. Thirty-one classes were recruited before the intervention as sources of our participants. In most Chinese public kindergartens, children within the same class are the same age. Depending on the children's age when the XJP started, we recruited classes from two age cohorts: entry age four and entry age five. All the classes had at least 30% Uyghur-speaking children. Within each class, we randomly selected 8 to 9 Uyghur children to test, for a total of 256 Uyghur participants. According to Optimal Design software (Raudenbush et al., 2011), with this design and at this sample size, this study had moderate power (0.8) to detect an effect size of a 0.48 standard deviation at traditional levels (0.05) of Type 1 error.

Procedures

The blocked randomization. The significant differences between the two sites of our sample and the educational differences between the excellent and normal kindergartens would lead to bias unless we used a sophisticated design. Therefore, instead of complete randomization, we used a blocked randomization process at the class level, blocked by city, the kindergarten ranking, and children's entry age cohort.

In our sample, 16 classes were in excellent level kindergartens, of which eight were randomized in the treatment group. The remaining 15 classes were in the normal ranked kindergartens, of which eight were randomized in the control group. Twelve classes were in the entry-age-4 cohort while 19 classes were in the entry-age-5 cohort. The randomization was also blocked on age cohort. Sixteen classes were assigned to the treatment group (three age-4/excellent classes; three age-4/normal classes; five age-5/excellent classes, five age-5/normal classes), and 15 classes to the control group (three age-4/excellent classes; three age-4/normal classes; four age-5/excellent classes, five age-5/normal classes). There were no significant differences in children's ages, genders, or Uyghur or Chinese vocabulary scores between the treatment and control group at the beginning of the study. Table 1 shows the background information of classes and children in both treatment and control groups.

Treatment fidelity. To ensure that treatment classes were conducting the required curriculum of the intervention, the XJP training staff visited the treatment classes every three weeks during the one-year intervention. During each visit, the staff observed and evaluated whether the teachers were following the Project's teaching plan. Information on children's attendance, curriculum progress, and teachers' self-reports on curriculum evaluation were collected. The staff also visited control group classes every three weeks to check if their teaching approaches were affected by the interventions in the neighboring classrooms. The observation reports suggested no evidence of contamination. The control group did not use any of the material provided to the treatment group. The teachers of treatment group reported that they were able to complete 82–90% of the curriculum plan. In each curriculum plan for the treatment group, there are 5 topics that each teacher is required to discuss with students. According to the teachers' self-reporting, each teacher was able to complete at least 4 of the 5 topics.

Data collection and instruments. The research team tested 256 Uyghur children individually on their Chinese and Uyghur receptive and expressive vocabulary. In testing the Chinese receptive vocabulary, we used the Chinese version of the Peabody Picture Vocabulary Test (PPVT, Lu & Liu, 1998). However, there was no existing Chinese-version expressive vocabulary test. We used the Chinese Expressive Vocabulary Test (EVT) adapted from the Expressive Vocabulary Test (Williams, 1997) by researchers of the Child Language Research Center (CLRC) of

East China Normal University. The CLRC team translated the test from English to Chinese, deleted or replaced the culturally (e.g. chopsticks instead of fork) and linguistically inappropriate items (e.g. the words "light" and "lamp" both refer to "灯" in Chinese), and piloted twice. In total, the CLRC tested 432 monolingual Mandarin-speaking children aged 3 to 6 in two eastern provinces in China to check the reliability of the Chinese EVT (Li, 2013).

Since there was no existing Uyghur vocabulary test for young children, we collaborated with the CLRC and researchers in the Department of Uyghur Language of Xinjiang Normal University to develop the Uyghur versions of receptive and expressive vocabulary tests. The Uyghur receptive and expressive vocabulary tests were translated from the Chinese PPVT and the Chinese EVT. Researchers deleted or replaced the culturally (e.g. items related to pig/bacon were deleted to respect Uyghur as Muslim) and linguistically inappropriate items (items that cannot appropriate translate into Uyghur) and conducted two pilots in Urumqi. Two hundred ninety-three Mandarin-Uyghur bilingual children were tested to check the reliability of the Uyghur PPVT and Uyghur EVT (Alimujiang, 2014).

All four vocabulary tests in two languages were administered on three occasions: in April 2012, September 2012, and March 2013. The test window for each wave was approximately two weeks. The average testing time for each child was about 20 minutes. Chinese vocabulary testers were 6 monolingual Mandarin-speaking graduate students. Uyghur vocabulary testers were 6 Mandarin-Uyghur bilingual graduate students. All the testers were majoring in early childhood education at local universities. Prior to data collection, testers received training via workshops and practiced testing with children ages 4 to 6 from schools outside of the study. The testers were blind to treatment and control conditions.

Measurement

Measures of children's vocabulary development were obtained in both Chinese and Uyghur using translated standardized measurements.

Outcomes.

Chinese receptive vocabulary (PPVT Chinese). We measured receptive vocabulary using the Peabody Picture Vocabulary Test Revised (PPVT-R) that had been translated into Chinese, validated, and normalized in Taiwan (Lu & Liu, 1998). Possible scores range from 0 to 115. In our sample, the internal consistency yielded a Cronbach's alpha of 0.79.

Chinese expressive vocabulary (EVT Chinese). We used the Chinese Expressive Vocabulary Test adapted by the CLRC to test Uyghur children's expressive vocabulary in Chinese. Possible scores range from 0 to 87. The internal consistency yielded a Cronbach's alpha of 0.89.

Uyghur receptive vocabulary (PPVT Uyghur). We measured children's receptive vocabulary using the PPVT test translated into Uyghur. Possible raw scores ranged from 0 to 97. The internal consistency yielded a Cronbach's alpha of 0.86.

Uyghur Expressive Vocabulary (Uyghur EVT). We used the translated Uyghur Expressive Vocabulary Test (EVT) to evaluate children's Uyghur expressive vocabulary. Possible raw scores ranged from 0 to 74. The internal consistency yielded a Cronbach's alpha of 0.66.

Predictors

T is the time predictor in this study. *T* equals child's XJP entry age (4 or 5) subtracted from his/her age at each test. *T* indicates the amount of time children spent in the study.

XJP is a binominal variable that specifies whether a class participated in the XJP intervention (*XJP* = 1) or not (*XJP* = 0). 134 children were coded as *XJP* =1. 122 children were coded as *XJP* = 0.

XJP*×*T is the question predictor that illustrates whether the XJP caused the more rapid development of the vocabulary of Uyghur children.

Covariates.

EntryAge5 *EntryAge5* is a binominal variable that specifies if a student participated in the XJP intervention in age cohort 5 (*EntryAge5* = 1) or 4 (*EntryAge5* = 0). 160 children in 19 classes were coded as *EntryAge5* = 1, while 96 children in 12 classes were coded as *EntryAge5* = 0.

Excellent. *Excellent* is a binominal variable that indicates the CoE evaluation of a kindergarten as high ranking (*Excellent* = 1) or low ranking (*Excellent* = 0). We employed this ranking in the multilevel modeling as a level 2 covariate to reduce the intra-class differences and improve the precision of the estimate of the intervention effectiveness. As we explained in the kindergarten section, we consider that *Excellent* is also an indicator of high SES in children's families. Typically, children from high-SES families attend kindergartens ranked as excellent (*Excellent* = 1). Low-SES kindergarteners generally attend normal kindergartens (*Excellent* = 0). 16 classes (130 children) were coded as *Excellent* = 1. 16 classes (126 children) were coded as *Excellent* = 0.

Data-Analytic Approach

Modeling the individual change over time. Since there are no norms in Chinese or Uyghur PPVT/EVT for Uyghur bilingual children, we decide to use raw scores of these four vocabulary tests in the data analysis. We used individual growth modeling (IGM) employing the multilevel model for change (Singer & Willett, 2003), with children's duration in the XJP as time predictor. With all the children's data from all three waves in a person-period data set, we completed the estimation using the generalized linear mixed models (GLMM) (Rabe-Hesketh, Skrondal, & Pickles, 2005) and XTMIXED with the full maximum likelihood in STATA.

As a suitable analytic tool to evaluate the longitudinal efficacy of this educational intervention, IGM is designed to analyze longitudinal data from individuals over time (Singer & Willett, 2003). Compared with traditional intervention evaluation tools that use only pre- and post-test data, IGM not only provides more precise results but answers additional questions about observed changes in learning rates.

Dealing with the floor effect. In the preliminary data analysis, we found that the pre-test of *PPVT Chinese*, *EVT Chinese,* and *PPVT Uyghur* had a strong floor effect. The floor effect is a very common (and concerning) observation in early language development studies, especially in bilingual studies (Muter et al., 2004). In this study, we assume that the Chinese PPVT, Chinese EVT, and Uyghur PPVT tests were too difficult to capture the wide range of 4-year-old Uyghur kindergarteners' language skills. To address the floor effects and reduce estimation bias, we introduced the Tobit model (Twisk & Rijmen, 2009), which assumes there is a new latent variable (Y*) with a normally distributed error term to capture the random influences of the original variable (Y) with floor effects. With GLMM framework (Rabe-Hesketh, Skrondal, & Pickles, 2005), a longitudinal Tobit analysis can be performed with STATA software. We set *Vocabulary** as a non-censored, random, latent variable with no floor effect. Because the distribution for *Vocabulary* is different from the distribution for *Vocabulary,** we needed to define the distribution of the residual of *Vocabulary** in GLMM in the longitudinal Tobit analysis.

Model identification. Thus, the multilevel model for the change of *PPVT Chinese*, *EVT Chinese*, and *PPVT Uyghur* expressed in composite form is:

$$Vocabulary^*_{ij} = [\gamma_{00} + \gamma_{01} XJP_i + \gamma_{10} T_{ij} + \gamma_{11} XJP_i \times T_{ij}] + [\zeta_{0i} + \zeta_{1i} T + \varepsilon_{ij}],$$

Where $\varepsilon_{ij} \sim N(o, \sigma_\varepsilon^2)$ and $\begin{bmatrix} \zeta_{0i} \\ \zeta_{1i} \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix} \begin{bmatrix} \sigma_0^2 & \sigma_{01} \\ \sigma_{10} & \sigma_1^2 \end{bmatrix} \right)$

Notice that the time predictor, *T*, is specified by the child's entry age subtracted from the child's age at the second and third tests: *T* = (child's age – entry age). This specification enabled a meaningful interpretation of the

parameter estimates: γ_{00} represents the average score for the children at age 4 or age 5 (the first measurement point); γ_{10} represents the average instantaneous slope; and γ_{11} represents the average change of rate of vocabulary learning between the XJP and control group. The random effect ε_{ij} is a level-1 residual. Using the longitudinal Tobit analysis, we assume that for each child *i* at time *j*, ε_{ij} follows a normal distribution with 0 and σ_{ε}^2. ζ_{0i} represents the residual for intercept, while ζ_{1i} represents residual for the slope.

Since the *EVT Uyghur* has a normal distribution (no detectable floor effect), we used traditional longitudinal data analysis, XTMIXED. Thus, the multilevel model for the change of *EVT Uyghur* expressed in composite form is:

$$Vocabulary_{ij} = [\gamma_{00} + \gamma_{01} XJP_i + \gamma_{10} T_{ij} + \gamma_{11} XJP_i \times T_{ij}] + [\zeta_{0i} + \zeta_{1i} T + \varepsilon_{ij}],$$

where $\varepsilon_{ij} \sim N(o, \sigma_{\varepsilon}^2)$ and $\begin{bmatrix} \zeta_{0i} \\ \zeta_{1i} \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix} \begin{bmatrix} \sigma_0^2 & \sigma_{01} \\ \sigma_{10} & \sigma_1^2 \end{bmatrix} \right)$

The interpretation of the parameter estimation is similar to the other three outcomes.

Results

Descriptive

The means and standard deviations for the Uyghur kindergarteners' Chinese receptive vocabulary, Chinese expressive vocabulary, Uyghur receptive vocabulary, and Uyghur expressive vocabulary are reported in Table 2. In the pre-test (April 2012), the vocabulary test scores are not significantly different between the XJP and the control group. After each six month test (in September 2012 and in March 2013), it is obvious that on average, all four outcomes increase. However, different variables have slightly different growth patterns. Chinese receptive vocabulary showed the greatest growth although there were slightly different growth patterns in different groups.

Growth Modeling

Table 3 presents the results of a series of multilevel models fitted to illustrate the differences between the treatment and control groups of the Uyghur children in Chinese and Uyghur vocabulary acquisition rate.

Chinese vocabulary growth. To answer our first research question about the intervention impact on Uyghur children's Chinese vocabulary development, we fit models for Chinese receptive vocabulary (*PPVT Chinese*) and expressive vocabulary (*EVT Chinese*). For Chinese receptive vocabulary (*PPVT Chinese*), the parameter estimation shows that the XJP significantly increased the growth rate of Chinese receptive vocabulary (See Model 1 in Table 3). The main effects of *EntryAge5* (γ_{02}) and *Excellent* (γ_{04}) are significant ($\gamma_{02} = 8.77$, $p <$

0.01; γ_{04} = 9.44, p ＜ 0.05), and the interaction of *Excellent* × *T*× *XJP* (γ_{15}) was also significant (γ_{15} = 11.58, p ＜ 0.05). Although the interaction terms of *Excellent* × *T* (γ_{14}) and *Excellent* × *XJP* (γ_{05}) were not statistically significant (γ_{14} = 5.06, $p > 0.05$; γ_{05} = 5.37, $p > 0.05$), we keep them in the final model for the significant three-way interaction (*Excellent* × *T*× *XJP*). The significant main effects (*EntryAge5* and *Excellent*) indicate that children in different age cohorts (4-year and 5-year) had different Chinese PPVT scores on the baseline test (Figure 1(A) and (B) show that each line has a different intercept). Meanwhile, the significant interaction of *Excellent* × *T*× *XJP* means that treatment classes within higher-ranking kindergartens have grown their vocabularies significantly faster than those in the control group. This finding indicates that the effect of the XJP emerged in the higher-ranked, or *Excellent*, schools. We also fit the Chinese expressive vocabulary (*EVT Chinese*) models; however, as shown in Model 2, we found no significant differences between the treatment and control groups on Chinese expressive vocabulary growth rate (γ_{11} = 0.02, $p > 0.05$).

Thus, in Chinese vocabulary development, the XJP seems to have promoted faster growth on receptive vocabulary development for Uyghur children within high-ranking kindergartens, when the entry age of intervention was controlled for. Figure 1 shows the different growth trajectories for children's Chinese receptive vocabulary development in normal and excellent ranked kindergartens. In Figure 1(A), the fitted lines show that when controlling for the *Excellent* and *EntryAge5* variables, children in low-ranked (normal) kindergartens who participated in the XJP increased their PPVT Chinese scores by 4.8 points per year more than the control group, but these results are not significant (γ_{11} = 4.83, $p > 0.05$). Children in the *EntryAge5* cohort scored 8.8 points higher than their cohorts in the control group at the end of the intervention (γ_{02} = 8.77, p ＜ 0.01). Figure 1(B) shows the differences in growth trajectories of Uyghur children in high-ranking (*Excellent*) kindergartens. Controlling for the entry age, the XJP leads to an increase of 11.58 points per year in children's *PPVT Chinese* score (γ_{15} = 11.58, p ＜ 0.01) over the control group. We used the combined standard deviation for the PPVT Chinese assessment across all occasions of the control group (*S.D.* = 13.88) to calculate the effect size. The unstandardized coefficient of 9.46 for the interaction of *XJP* and *T* (not reported in Table 2) corresponds to an effect size of 68% of a standard deviation per year.

Uyghur vocabulary growth. To answer the second research question about the effect of the XJP on the Uyghur children's Uyghur vocabulary development, we fitted models for Uyghur receptive vocabulary (*PPVT Uyghur*) and Uyghur expressive vocabulary (*EVT Uyghur*). We followed the same procedures again with Uyghur

vocabulary outcomes to estimate the parameters. Although the results indicated no significant difference between the treatment and control groups on Uyghur receptive vocabulary acquisition (see in Model 3, $\gamma_{11} = 2.70$, $p > 0.05$), we found a significant main effect of *T* and an interaction effect of *XJP* and *T* on Uyghur expressive vocabulary development (see Model 4).

Model 4 was the final model employed to test our second research question of whether there would be a significant difference for Uyghur expressive vocabulary growth between the treatment and control groups. Children who received the XJP intervention evidenced a faster increase in Uyghur expressive vocabulary development than the control group ($\gamma_{11} = 3.70$, $p < 0.05$). There is no significant interaction between age groups and the kindergarten ranking. Figure 2 shows that the children who participated in the XJP in both entry-age-4 and entry-age-5 cohorts had the same rapid development in Uyghur expressive vocabulary, about 3.7 points higher on the EVT Uyghur test than the control group of Uyghur students. Based on the combined standard deviation for the EVT Uyghur across all occasions of the control group ($SD = 9.89$), the effect size is 38% of a standard deviation per year.

Robustness checks

Robustness checks were conducted to address two main concerns. First, we checked the robustness of the longitudinal Tobit regression. Since the Tobit regression relies on the strong assumption of an underlying normal distribution of the un-truncated data, we also ran the generalized linear mixed effects models using the un-truncated data. The results of three of the outcomes—PPVT Chinese, EVT Chinese and PPVT Uyghur—were consistent with our original Tobit model findings. EVT Uyghur was not tested because the data of this test did not show floor effect in the beginning. The quantity of interests (main effects of the XJP on vocabulary outcomes) varied a little, yet the statistical significance was the same. Second, we lost seventeen children in the second and third waves of tests. We ran analysis with multiple imputation (Rubin, 2004) and found the results of the XJP efficacy were consistent with the findings of models without imputed data (results available from authors).

Threats to Validity

Three critical concerns threaten the validity of this study. First, seventeen children in the entry-age-5 cohort could not be tested in the second and third waves of data collection (due to family transition to another city). Our results indicated that older children had a higher intercept than the younger children. The missing data problem may lead to bias in the estimation.

The second threat comes from the geographical bias of our sample: Most of the classes (n = 23) live in the capital city of Xinjiang Province, Urumqi, which enjoys the best bilingual environment and economic status in Xinjiang. Since the school recruitment was not conducted by a complete randomization within a school pool, there may be selection bias that schools who are willing to participate in educational experiments will be more likely to join the project. Caution should be taken when generalizing the results of this study to other areas of Xinjiang Province with higher poverty rates and other schools that may have a lower motivation to improve education quality.

Furthermore, though the psychometric properties of the vocabulary assessments used were acceptable, these are novel instruments that have not been standardized for this population or, in the case of the Uyghur assessments, for any group.

Discussion

This study evaluates the treatment effects of an experimental book reading intervention implemented in Xinjiang Province, a Uyghur-Chinese bilingual region with the lowest GDP per capita in China. Measured by general vocabulary tests, the results show that the intervention affected both the Chinese receptive vocabulary and Uyghur expressive vocabulary development of Uyghur children. The intervention appears to have led to a more rapid development of Chinese receptive vocabulary; the effect size was 0.68, which is considered high in educational research (Cohen, 1988). It also increased the development rate of Uyghur children's Uyghur expressive vocabulary with an effect size of 0.38 of a standard deviation.

Interestingly, this study finds that the XJP intervention affected Uyghur children's first- and second-language development differently. For their first language, Uyghur, the intervention helped the children develop expressive vocabulary faster but not receptive vocabulary; in contrast, for their second language, Mandarin Chinese, the intervention helped them develop receptive vocabulary faster but not expressive.

Unpack the effects: Why does the XJP work?

Book reading as a powerful scaffolding. As previous researchers have suggested, book reading is a significant way to provide vocabulary rarely found in daily life (Weizman & Snow, 2001). In the XJP, picture books with diverse topics provided teachers with abundant opportunities to develop language education curriculum and class activities. With the help of picture books, the XJP teachers conducted interesting discussions of diverse topics (e.g. animals, traditional festivals, music, and dance). Book reading not only provided content but also could easily be related to children's daily experiences (Snow, Burns & Griffin, 1998). Teachers used the pictures in the books to

create scaffold memories and imagined experiences outside of schools, which were likely crucial to language learning (Beck et al., 2004).

We also suggest that the varied contents and stories of picture books could be the source of the development of children's Uyghur expressive vocabulary. The topics of the shared reading may encourage children to expand the discussion outside the school. It is possible that children get more opportunity to practice Uyghur expressive vocabulary when they retell stories and share knowledge in Uyghur with parents and peers in their communities.

Reading accelerates meaningful changes in classrooms. The XJP not only brought picture books but also asked teachers to conduct a new language-learning curriculum. During the XJP intervention, each weekday the XJP classes have an extra 20 minutes of language learning over the control classes. That means that after a one-year intervention, each XJP child received 3,600 more minutes (5 classes/week × 18 weeks/semester × 2 semesters/year) of language learning than control children. These vocabulary-learning opportunities are important for second-language learners to conceptualize words and their context (August & Shanahan, 2006; Girolametto, Pearce & Weitzman, 1996). We believe this aspect of the XJP intervention is behind the growth of the children's receptive vocabulary in Chinese. Discussion in the classroom may also provoke an active connection between words and knowledge in the real world (Lonigan & Shanahan, 2009). Real-world knowledge serves as the basis of vocabulary learning for both L1 and L2 (Carlo et. al, 2004; Slavin & Chueng, 2005). In the XJP, vocabulary instruction likely provided a solid base for Uyghur children's understanding. A growth in real-world knowledge may have helped Uyghur children to improve both L1 and L2 vocabulary.

Understanding the non-significant results

Why Chinese receptive but not expressive? The findings suggest that the XJP intervention improved Uyghur children's Chinese receptive but not expressive vocabulary development. These seemingly conflicting findings can be explained by research on the unbalanced development of receptive vocabulary and expressive vocabulary among bilingual students (Sénéchal, 1997). Expressive vocabulary development requires more cognitive and psychological ability than receptive vocabulary, and, further, this ability develops later than expressive vocabulary. The enriched language input of the XJP was evidently a catalyst for children's receptive vocabulary development. However, the intervention only lasted two semesters, which is not an extensive amount of time for

early language development. Possibly, more time is needed for Uyghur children to benefit in a way that extends to expressive vocabulary in a second language.

Why Uyghur expressive but not receptive? Results also suggest that the XJP helped improve the rate of Uyghur children's expressive vocabulary development of their mother language. This finding is very interesting because more than 80% of the teachers we recruited could speak only Chinese. Based on the teachers' language ability, we believe that increasing the rate of development of expressive language may not normally happen in the classroom. When focusing on the content of the intervention, we found that the intervention provided some interesting topics and content (e.g. music, local culture, adults' jobs) that children might well have been motivated to discuss with each other and with adults. It is very possible that the content of the intervention inspired children communicate with their peers and families in the Uyghur language. Outside of school, the vocabulary learning very likely continued. Research also has found that multicultural picture books can provide positive messages to help young children understand and enjoy their cultural background (Boyd, Causey & Galda, 2015). As the social equity theory suggested (McKown, 2013), bilingual picture books may also communicate the message to LM children that their first language is worth keeping, which can also encourage them to speak and use their first language more than if it were not encouraged.

Why did specific groups of children benefit? The findings of this study suggest that older children, as well as children from high quality kindergartens with potentially high-SES backgrounds, benefit more in their Chinese receptive vocabulary growth from the XJP. According to the previous studies of bilingual and low-SES children's vocabulary growth (Hoff, 2013; Pan, Rowe, Singer & Snow, 2005; Sliverman, 2007), we believe that the development of young children's L2 vocabulary is not linear. Older children may have a stronger knowledge base to understand the content of L2 vocabulary, thus leading to a faster growth during the XJP. Older children may also have more experiences of picture book reading, which may help them benefit more from this type of intervention. Our findings call for more exploration of Uyghur children's L2 vocabulary developmental trajectories.

Additionally, this study indicates that children in high-ranking kindergartens benefited more from the intervention. This result is consistent with the previous findings of vocabulary interventions showing that children from low-SES backgrounds gain less than their peers from middle- or upper-SES families (Marulis & Neuman, 2013). Our finding suggests the possibility of further revision of the intervention content in order to help lower ranking kindergartens. It is possible that the low-ranking kindergarten students may not have had sufficient

educational resources (e.g., teachers' limited education background) to support their learning and the teachers may not have had enough assistance to support their teaching of the new curriculum. Also, students in these low-SES kindergartens have significantly lower initial language skills, suggesting that a revised, two-version intervention focusing on different subgroups is necessary; for instance, low-SES children attending low-ranked kindergartens who have fewer resources and greater needs should have more specialized education plans.

Early Bilingual Education Policy in Xinjiang: What's Next?

Given the shift from the BEE to the new bilingual curriculum in early childhood education, we note that the early bilingual education policy in Xinjiang has not been static. However, achieving successful bilingual education in Xinjiang is still a serious challenge. According to the Bilingual Education Development Plan for Xinjiang Kindergartens, by 2020, 85% of language minority children in Xinjiang should enjoy two-year kindergarten bilingual education before they enter elementary school. When this goal is achieved everywhere except several remote rural areas, all schools (from elementary to high school) will only provide immersion in Chinese curriculum for all courses (Xinjiang Department of Education, 2013), which means Chinese will be the only academic language in formal school settings. This policy places great emphasis on early bilingual education. Since the two-year bilingual education in kindergarten will be the only opportunity for Uyghur and other language minority children to prepare for Chinese immersion, this window should be exploited to the utmost. The XJP study is the first and, so far, the only empirical evidence that it is possible to enrich language learning in this context through shared book reading activities in the classroom, fostering class discussion, and preparing teachers to promote bilingual development. For policy-makers, this study suggests the feasibility and promise of the new early bilingual education curriculum.

References

Akhtar, N., & Tomasello, M. (2000). The social nature of words and word learning. *Becoming a word learner: A debate on lexical acquisition*, 115-135.

Alimujiang, A. (2014). *Study on Vocabulary Development of 4-6 Uygur Bilingual Children in Urumqi*. (Master's thesis). Xinjiang Normal University, Urumqi, China.

August, D., & Shanahan, T. (Eds.). (2006). Developing literacy in second-language learners: Report of the National Literacy Panel on Language Minority Children and Youth.

Beck, I. L., McKeown, M. G., & Kucan, L. (2004). Direct and rich vocabulary instruction. *Vocabulary instruction: Research to practice*, 13.

Boyd, F. B., Causey, L. L., & Galda, L. (2015). Culturally Diverse Literature. *The Reading Teacher*, 68(5), 378-387.

Brock, L. L., Nishida, T. K., Chiong, C., Grimm, K. J., & Rimm-Kaufman, S. E. (2008). Children's perceptions of the classroom environment and social and academic performance: A longitudinal analysis of the contribution of the "Responsive Classroom" approach. *Journal of School Psychology*, *46*(2), 129-149.

Carlo, M. S., August, D., McLaughlin, B., Snow, C. E., Dressler, C., Lippman, D. N., ... & White, C. E. (2004). Closing the gap: Addressing the vocabulary needs of English-language learners in bilingual and mainstream classrooms. *Reading Research Quarterly*, *39*(2), 188-215.

Cha, K., & Goldenberg, C. (2015). The complex relationship between bilingual home language input and kindergarten children's Spanish and English oral proficiencies. *Journal of Educational Psychology*, *107*(4), 935.

Chen, S. (2014). *The Effectiveness of a Chinese Literacy Intervention for Uyghur Young Children: A Randomized Controlled Trail* (Unpublished doctoral dissertation). East China Normal University, Shanghai, China.

Cheung, A., & Slavin, R. E. (2005). Effective reading programs for English language learners and other language-minority students. *Bilingual Research Journal*, *29*(2), 241-267.

China Ministry of Education. (2012). *Early Learning and Development Guideline*. Retrieved from http://www.moe.gov.cn/publicfiles/business/htmlfiles/moe/s7371/201305/152136.html

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences (2nd ed.).* Hillsdale, NJ: Erlbaum.

Cummins, J. (1979). Linguistic interdependence and the educational development of bilingual children. *Review of educational research*, *49*(2), 222-251.

Cunningham, A. E., & Stanovich, K. E. (1997). Early reading acquisition and its relation to reading experience and ability 10 years later. *Developmental Psychology*, *33*(6), 934-945.

De Temple, J., & Snow, C. E. (2003). Learning words from books. In A. van Kleeck, S.A. Stahl, & E. B. Bauer (Eds.), *On reading books to children: Parents and teachers* (pp. 16–36).

Dickinson, D. K., & Tabors, P. O. (2001). *Beginning literacy with language: Young children learning at home and school*. Baltimore, MD: Brookes Publishing.

Farver, J. A. M., Lonigan, C. J., & Eppe, S. (2009). Effective early literacy skill development for young Spanish-speaking English language learners: An experimental study of two methods. *Child Development*, *80*(3), 703-719.

Girolametto, L., Pearce, P. S., & Weitzman, E. (1996). Interactive focused stimulation for toddlers with expressive vocabulary delays. *Journal of Speech, Language and Hearing Research*, *39*(6), 1274.

Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore, MD: Brookes Publishing.

Harwell, M., & LeBeau, B. (2010). Student eligibility for a free lunch as an SES measure in education research. *Educational Researcher*, *39*(2), 120-131.

Hassinger-Das, B., Ridge, K., Parker, A., Golinkoff, R. M., Hirsh-Pasek, K., & Dickinson, D. K. (2016). Building Vocabulary Knowledge in Preschoolers Through Shared Book Reading and Gameplay. *Mind, Brain, and Education*.

Hoff, E. (2003). The specificity of environmental influence: Socioeconomic status affects early vocabulary development via maternal speech. *Child Development*, *74*(5), 1368-1378.

Hoff, E. (2013). Interpreting the early language trajectories of children from low-SES and language minority homes: implications for closing achievement gaps. *Developmental psychology*, *49*(1), 4.

Hoff, E., & Tian, C. (2005). Socioeconomic status and cultural influences on language. *Journal of Communication Disorders*, *38*(4), 271-278.

Huang, X, Y. (2011). Delayed language development of children in bilingual education. *Journal of Longyan University*, *3*, 22.

Huttenlocher, J., Haight, W., Bryk, A., Seltzer, M., & Lyons, T. (1991). Early vocabulary growth: Relation to language input and gender. *DevelopmentalPsychology*, *27*(2), 236.

Jalongo, M. R. (2000). *Early childhood language arts: Meeting diverse literacy needs through collaboration with families and professionals*. Needham Heights, MA: Allyn and Bacon.

Jalongo, M. R., & Sobolak, M. J. (2011). Supporting young children's vocabulary growth: The challenges, the benefits, and evidence-based strategies. *Early Childhood Education Journal*, *38*(6), 421-429.

Johnson, I. (2013). China's Sufis: The shrines behind the dunes. *The New York Review of Books,* April 25, 2013. Retrieved from http://www.nybooks.com/blogs/nyrblog/2013/apr/25 /china-xinjiang-sufi-shrines/

Kohnert, K., Yim, D., Nett, K., Kan, P. F., & Duran, L. (2005). Intervention with linguistically diverse preschool children: A focus on developing home language (s). *Language, Speech, and Hearing Services in Schools*, *36*(3), 251.

Lee, J. (2011). Size matters: Early vocabulary as a predictor of language and literacy competence. *Applied Psycholinguistics*, *32*(1), 69.

Lesaux, N. K., Rupp, A. A., & Siegel, L. S. (2007). Growth in reading skills of children from diverse linguistic backgrounds: Findings from a 5-year longitudinal study. *Journal of Educational Psychology*, *99*(4), 821-834.

Li, C.J. (2013). *Research on the Semantic Development of Xinjiang Minority Young Children* (Master's thesis). East China Normal University, Shanghai, China.

Li, S.G., & Cai, W.L. (2012). Challenges of Xinjiang bilingual education in elementary school. *Journal of Hetian Normal University*, 31(3).

Loftus, S. M., Coyne, M. D., McCoach, D. B., Zipoli, R., & Pullen, P. C. (2010). Effects of a supplemental vocabulary intervention on the word knowledge of kindergarten students at risk for language and literacy difficulties. *Learning Disabilities Research & Practice*, *25*(3), 124-136.

Lonigan, C. J., & Shanahan, T. (2009). Developing Early Literacy: Report of the National Early Literacy Panel. Executive Summary. A Scientific Synthesis of Early Literacy Development and Implications for Intervention. *National Institute for Literacy*.

Lu, L., & Liu, H. S. (1998). *The peabody picture vocabulary test-revised in Chinese.* Taipei: Psychological Publishing.

Ma, R. (2008). Minority Education and Practice of Bilingual Teaching in Xinjiang. *Peking University Education Review*, 2(3).

Marchman, V. A., & Fernald, A. (2008). Speed of word recognition and vocabulary knowledge in infancy predict cognitive and language outcomes in later childhood. *Developmental Science*, *11*(3), F9-F16.

Marulis, L. M., & Neuman, S. B. (2010). The effects of vocabulary intervention on young children's word learning: A meta-analysis. *Review of Educational Research*, *80*(3), 300-335.

Marulis, L. M., & Neuman, S. B. (2013). How vocabulary interventions affect young children at risk: A meta-analytic review. *Journal of Research on Educational Effectiveness*, *6*(3), 223-262.

McKeown, M. G. (2012). Direct and rich vocabulary instruction needs to start early. *Vocabulary Instruction: Research to Practice*, 17.

McKown, C. (2013). Social Equity Theory and Racial-Ethnic Achievement Gaps. *Child development*, *84*(4), 1120-1136.

Mol, S. E., Bus, A. G., & de Jong, M. T. (2009). Interactive book reading in early education: A tool to stimulate print knowledge as well as oral language. *Review of Educational Research*, *79*(2), 979-1007.

Morgan, P. L., Farkas, G., Hillemeier, M. M., Hammer, C. S., & Maczuga, S. (2015). 24, C. S., & Maczuga &With Larger Oral Vocabularies Display Greater Academic and Behavioral Functioning at Kindergarten Entry. *Child development, 86*(5), 1351-1370.

Muter, V., Hulme, C., Snowling, M. J., & Stevenson, J. (2004). Phonemes, rimes, vocabulary, and grammatical skills as foundations of early reading development: Evidence from a longitudinal study. *Developmental Psychology*, *40*(5), 665-680.

National Bureau of Statistics of the People's Republic of China. (2010). Tabulation on the 2010 Population Census of the People's Republic of China. Retrieved from http://www.stats.gov.cn/tjsj/pcsj/rkpc/6rp/indexch.htm

Neuman, S. (2011). The challenge of teaching vocabulary in early education. *Handbook of early literacy research*, *3*, 358-372.

Pan, B. A., Rowe, M. L., Singer, J. D., & Snow, C. E. (2005). Maternal correlates of growth in toddler vocabulary production in low-income families. *Child Development*, *76*(4), 763-782.

Patterson, J. L. (2004). Comparing bilingual and monolingual toddlers' expressive vocabulary size: Revisiting Rescorla and Achenbach (2002). *Journal of Speech, Language, and Hearing Research*, *47*(5), 1213.

Quiroz, B. G., Snow, C. E., & Zhao, J. (2010). Vocabulary skills of Spanish–English bilinguals: impact of mother–child language interactions and home language and literacy support. *International Journal of Bilingualism*.

Rabe-Hesketh, S., Skrondal, A., & Pickles, A. (2005). Maximum likelihood estimation of limited and discrete dependent variable models with nested random effects. *Journal of Econometrics*, *128*(2), 301-323.

Raudenbush, S. W., Spybrook, J., Congdon, R., Liu, X. F., Martinez, A., and Bloom, H. (2011). Optimal Design Software for Multi-level and Longitudinal Research (Version 3.01) [Software]. Available from www.wtgrantfoundation.org

Reese, E., Sparks, A., & Leyva, D. (2010). A review of parent interventions for preschool children's language and emergent literacy. *Journal of Early Childhood Literacy*, *10*(1), 97-117.

Roberts, T. A. (2008). Home storybook reading in primary or second language with preschool children: Evidence of equal effectiveness for second-language vocabulary acquisition. *Reading Research Quarterly*, *43*(2), 103-130.

Rowe, M. L., & Goldin-Meadow, S. (2009). Differences in early gesture explain SES disparities in child vocabulary size at school entry. *Science*, *323*(5916), 951-953.

Rubin, D. B. (2004). *Multiple imputation for nonresponse in surveys* (Vol. 81). John Wiley & Sons.

Ruston, H. P., & Schwanenflugel, P. J. (2010). Effects of a conversation intervention on the expressive vocabulary development of prekindergarten children. *Language, Speech, and Hearing Services in Schools*, *41*(3), 303.

Rydland, V., Grover, V., & Lawrence, J. (2013). The second-language vocabulary trajectories of Turkish immigrant children in Norway from ages five to ten: the role of preschool talk exposure, maternal education, and co-ethnic concentration in the neighborhood. *Journal of child language*, *41*(2), 352-381.

Sénéchal, M. (1997). The differential effect of storybook reading on preschoolers' acquisition of expressive and receptive vocabulary. *Journal of Child Language*, *24*(01), 123-138.

Sénéchal, M., Ouellette,G., & Rodney, D. (2006). The misunderstood giant: On the predictive role of early vocabulary to future reading. *Handbook of Early Literacy Research*, *2*, 173-182.

Silverman, R. D. (2007). Vocabulary development of English-language and English-only learners in kindergarten. *The Elementary School Journal*, *107*(4), 365-383.

Silverman, R., & Hines, S. (2009). The effects of multimedia-enhanced instruction on the vocabulary of English-language learners and non-English-language learners in pre-kindergarten through second grade. *Journal of Educational Psychology*, *101*(2), 305.

Silverman, R., Crandell, J. D., & Carlis, L. (2013). Read alouds and beyond: The effects of read aloud extension activities on vocabulary in Head Start classrooms. *Early Education & Development*, *24*(2), 98-122.

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: modeling change and event occurrence: modeling change and event occurrence*. Oxford: Oxford University Press.

Slavin, R. E., & Cheung, A. (2005). A synthesis of research on language of reading instruction for English language learners. *Review of Educational Research*, *75*(2), 247-284.

Snell, E. K., Hindman, A. H., & Wasik, B. A. (2015). How Can Book Reading Close the Word Gap? Five Key Practices From Research. *The Reading Teacher*, *68*(7), 560-571.

Snow, C. E., Burns, M. S., & Griffin, P. (Eds.). (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academies Press.

Statistic Bureau of Xinjiang Uyghur Autonomous Region. (2014a). *2014 Statistic Yearbook of Xinjiang Uyghur Autonomous Region.* Retrieved from http://www.xjtj.gov.cn/sjcx/zgxj_3740/zgxj2014/201509/t20150902_478515.html

Statistic Bureau of Xinjiang Uyghur Autonomous Region. (2014b). *2014 Statistic Yearbook of Xinjiang Uyghur Autonomous Region.* Retrieved from http://www.xjtj.gov.cn/sjcx/tjnj_3415/2014xjtjnj/rkjy_2014/201506/t20150630_471951.html

Statistic Bureau of Xinjiang Uyghur Autonomous Region. (2016). *2014 Child Development Report of Xinjiang*. Retrieved from http://www.xjtj.gov.cn/tjfx/201601/t20160125_488524.html

Sun, M.X. (2010). A Research on the pre-school bilingual teaching in Xinjiang: Problems and solutions. Journal of Xinjiang Education Institute. 26(3), 22-25

Sun, M.X. (2012). Reflection on the Use of Bilingual Preschool Textbooks among Ethnic Minorities in Xinjiang. *Journal of Xinjiang University (Philosophy, Humanities & Social Science)*. (1), 94-97

Tabors, P. O., & Snow, C. E. (2003). Young bilingual children and early literacy development. *Handbook of Early Literacy Research*, 159-178.

Tomasello, M. (2000). The item-based nature of children's early syntactic development. *Trends in cognitive sciences*, *4*(4), 156-163.

Turkheimer, E., Haley, A., Waldron, M., D'Onofrio, B., & Gottesman, I. I. (2003). Socioeconomic status modifies heritability of IQ in young children. *Psychological Science*, *14*(6), 623-628.

Tsung, L. T., & Cruickshank, K. (2009). Mother tongue and bilingual minority education in China. *International Journal of Bilingual Education and Bilingualism*, *12*(5), 549-563.

Twisk, J., & Rijmen, F. (2009). Longitudinal tobit regression: A new approach to analyze outcome variables with floor or ceiling effects. *Journal of Clinical Epidemiology*, *62*(9), 953-958.

Uccelli, P., & Páez, M. M. (2007). Narrative and vocabulary development of bilingual children from kindergarten to first grade: Developmental changes and associations among English and Spanish skills. *Language, Speech, and Hearing Services in Schools*, *38*(3), 225.

Walley, A. C. (1993). The role of vocabulary development in children's spoken word recognition and segmentation ability. *Developmental Review, 13*(3), 286-350.

Wang, A. S., Meng, F. L. (2006). The Development of Xinjiang Bilingual Education Policy for Minority Groups. *Journal of Research on Education for Ethnic Minorities, 17*(2), 22-27.

Wang, T. (2014). *A Research on the Teacher Questioning of Collective Teaching Activities in Bilingual Kindergarten of Xinjiang.* (Master's thesis). Xinjiang Normal University, Urumqi, China.

Wasik, B. A., Bond, M. A., & Hindman, A. (2006). The effects of a language and literacy intervention on Head Start children and teachers. *Journal of Educational Psychology*, *98*(1), 63.

Wasik, B. A., Hindman, A. H., & Snell, E. K. (2016). Book reading and vocabulary development: A systematic review. *Early Childhood Research Quarterly*, *37*, 39-57.

Weizman, Z. O., & Snow, C. E. (2001). Lexical output as related to children's vocabulary acquisition: Effects of sophisticated exposure and support for meaning. *Developmental psychology*, *37*(2), 265.

Williams, K. T. (1997). *Expressive vocabulary test*. Los Angeles, CA: American Guidance Service.

Xinjiang Department of Education. (2013). *Xinjiang Bilingual Education Development Plan for Preschool, Elementary, Middle and High School (2010-2020)*. Retrieved from http://www.xjedu.gov.cn/xjjyt/jyzt/xqjywlxz/xqsyzc/2013/60171.htm

Xinhua News Agency. (2015). Xinhua Insight: Bilingual education boosts development in Xinjiang. Retrieved from http://news.xinhuanet.com/english/2015-09/10/c_134611185.htm

Zhang, W.J. (2013). *Research on the Quality of Child Teacher Interaction in Xinjiang Kindergarten Classrooms*. (Master's thesis). East China Normal University, Shanghai, China.

Zhou, J., Li, C.J., Du, L.J., Wang, F.X., Chen, S., & Zhang, L. (2014). The Development of Mandarin Acquisition of Uyghur Children in Bilingual Preschools in Xinjiang. *Journal of East China Normal University (Education Science),* (1), 65-72.

Table 1

Table 1.
Background information of classroom and children in the treatment and control group (N=31, n=256).

	Mean	Standard Deviation	Minimum	Maximum
The XJP class (N = 16; n = 134)				
City	Class in Urumqi = 12		Class in Turpan = 4	
Ranking	Excellent ranking class = 8		Normal ranking class = 8	
Cohort	Entry-age four class = 6		Entry-age five class = 10	
Class size	45.8	5.4	40	55
Children's age (at baseline, entry to the XJP)	4.5	0.65	4.1	5.3
Number of girls in each class	22.3	6.1	15	28
Baseline Uyghur ability (expressive)	23.72	8.30	2	56
Baseline Chinese ability (expressive)	17.17	15.88	0	45
The control class (N = 15; n = 122)				
City	Class in Urumqi = 11		Class in Turpan = 4	
Ranking	Excellent ranking class = 8		Normal ranking class = 7	
Cohort	Entry-age four class = 6		Entry-age five class = 9	
Class size	46.9	5.7	40	56
Children's age (at baseline, entry to the XJP)	4.5	0.61	4.1	5.2
Number of girls in each class	22.1	5.7	16	26
Baseline Uyghur ability (expressive)	22.69	9.02	2	55
Baseline Chinese ability (expressive)	14.21	13.67	0	43

Table 2

Table 2.

Descriptive data of vocabulary test outcomes (N=31, n=256).

	The Xinjiang Project					Control group				
Vocabulary measures	N (n)	M	SD	Min.	Max.	N (n)	M	SD	Min.	Max.
PPVT Chinese										
α = 0.79										
Apr 2012	16(134)	11.39	12.82	0	45	15 (122)	12.90	11.98	0	43
Sep 2012	16(134)	19.82	21.22	1	66	15 (122)	15.08	14.37	1	58
Mar2013	16(127)	37.57	26.42	3	82	15 (112)	20.41	14.30	1	75
EVT Chinese										
α = 0.87										
Apr 2012	16(134)	17.17	15.88	0	44	15 (122)	14.21	13.67	0	45
Sep 2012	16(133)	23.63	18.07	1	57	15 (120)	21.56	16.00	1	55
Mar2013	16(127)	32.77	16.47	4	68	15 (112)	30.48	16.38	3	67
PPVT Uyghur										
α = 0.86										
Apr 2012	16(134)	20.38	12.33	3	56	15 (122)	20.73	11.70	4	58
Sep 2012	16(131)	21.18	19.30	7	72	15 (118)	20.36	16.36	9	77
Mar2013	16(127)	29.68	21.38	11	89	15 (112)	24.22	19.44	10	89
EVT Uyghur										
α = 0.66										
Apr 2012	16(134)	23.72	8.30	2	56	15 (122)	22.69	9.02	2	55
Sep 2012	16(133)	29.74	9.48	4	65	15 (118)	26.77	10.24	4	64
Mar2013	16(127)	29.69	10.31	7	70	15 (112)	27.68	9.56	9	70

Note. α is the Cronbach's alpha, to measure the score reliability of each vocabulary test.

Table 3

Table 3
Results of Individual Growth Models for Change for Chinese and Uyghur Vocabulary between Xinjiang Project and Control Group (N=31; n=256)

		Chinese		Uyghur	
		Model 1. receptive vocabulary (PPVT)	Model 2. expressive vocabulary (EVT)	Model 3. receptive vocabulary (PPVT)	Model 4. expressive vocabulary (EVT)
Fixed Effects					
Intercept	γ_{00}	1.51(3.92)	2.11(3.30)	13.30***(2.55)	23.36***(1.28)
XJP	γ_{01}	1.59(4.35)	1.21(3.26)	-1.77(2.77)	0.50(1.48)
T	γ_{10}	5.90(3.26)	7.89***(0.71)	1.65(0.96)	2.70*(1.10)
XJP × T	γ_{11}	4.83(4.30)	0.02(1.09)	2.70(1.46)	3.70*(1.60)
EntryAge5	γ_{02}	8.77**(2.73)	10.55**(3.15)	7.60**(2.37)	2.84*(1.28)
Excellent	γ_{04}	9.44*(3.97)	11.32**(3.05)	4.87*(2.31)	
Excellent × XJP	γ_{05}	5.37(5.55)			
Excellent × T	γ_{14}	5.06(3.97)			
Excellent × T × XJP	γ_{15}	11.58*(5.56)			
Variance Components					
Lev.1 Residual	σ_ε^2	201.19	11.68	15.28	77.32
Lev.2 Initial	σ_0^2	35.71	8.27	5.10	9.78
Lev.2 Rate of Change	σ_1^2	16.42	7.91	7.25	4.18
Goodness of fit					
-2LL		4777.16	2783.35	2718.55	4123.08
AIC		4803.16	5586.70	5457.09	4572.76
BIC		4860.52	5632.32	5501.88	4616.81

Note. AIC=Akaike information criterion; BIC=Bayesian information criterion;
*p<.05; **p<.01; ***p<.001

Figure 1

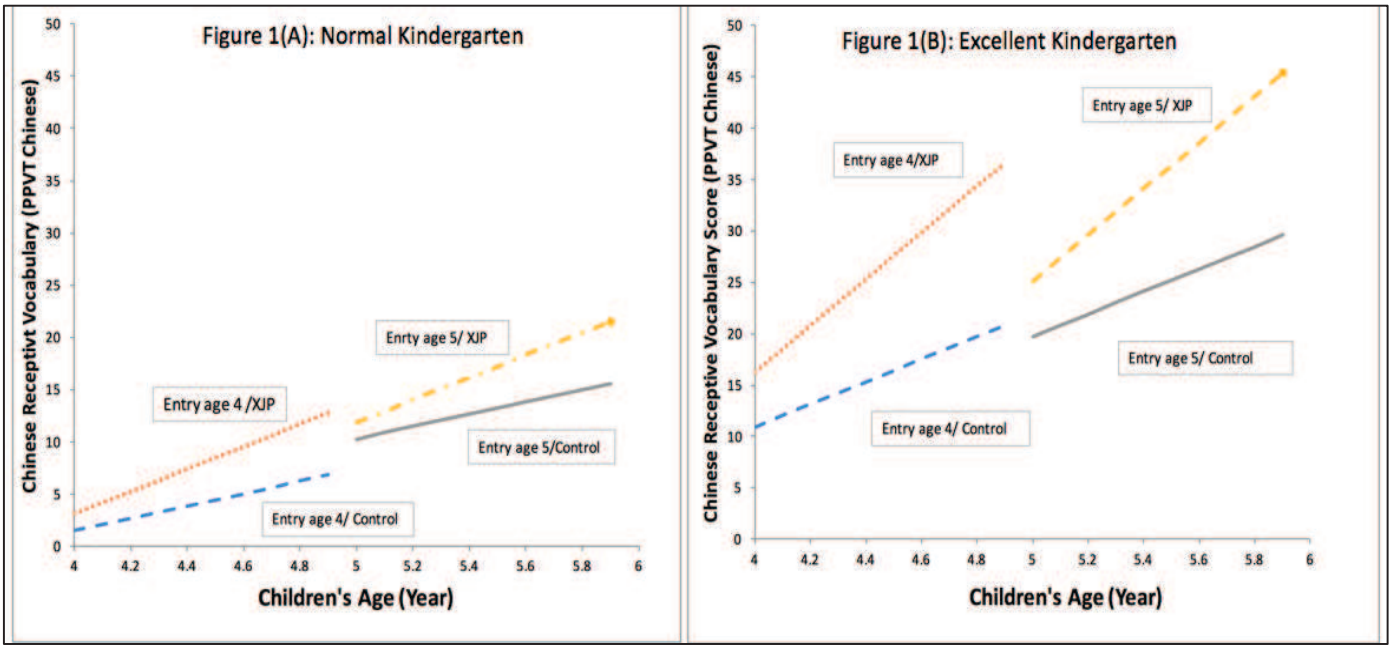

Figure 1. (A) (B) Average fitted growth trajectories for Uyghur children in low government ranking (*Excellent*=0) and high government ranking (*Excellent*=1) kindergartens that describe the effect of Xinjiang Project intervention and entry age cohort on the change in the Chinese receptive vocabulary.

Figure 2

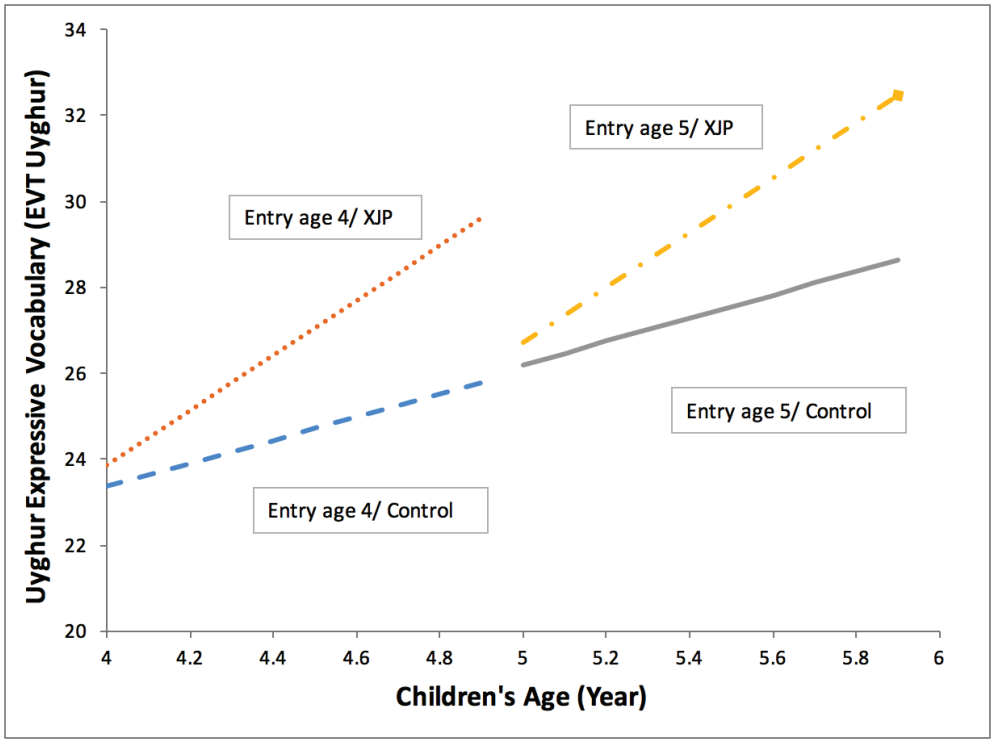

Figure 2. Average fitted growth trajectories for Uyghur children describe the effect of Xinjiang Project intervention and entry age cohort on the change in Uyghur expressive vocabulary.