

**Addressing Socio-economic Disparities in School Readiness with Evidence-based Preschool Programming and Professional Development Support**

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The landscape of early childhood education (ECE) has undergone dramatic changes in the United States during the last two decades, (Lowenstein, 2011), accompanied by fundamental shifts in the way that school readiness is conceptualized (Snow, 2006). Advances in developmental neuroscience research have fueled these changes by revealing the critical importance of early learning experiences for building the neural architecture that supports later learning (Blair & Raver, 2015). In this chapter, we describe the changing landscape of ECE and current conceptualizations of school readiness, the developmental research that underlies contemporary approaches, and the implications for ECE practice.

### **The Changing ECE Landscape and Contemporary Conceptualizations of School Readiness**

In 2015, 38% of American 3-year-olds, 67% of 4-year-olds, and 87% of 5-year-olds were enrolled in some kind of center-based ECE preprimary program (MacFarland et al., 2017). Adding to the federal funds that support Head Start programs, most states (43 of 50) now fund prekindergarten programs, increasing accessibility for children in low-income families (Friedman-Krauss et al., 2018). These high levels of public interest and investment in ECE reflect a growing body of research that links attendance at a high-quality preschool with a host of positive later outcomes, including enhanced school performance and educational attainment, better social-emotional adjustment, and even improved health (Yoshikawa et al., 2013).

Perhaps, in part, because of increasing attendance at preschool, expectations regarding the skill-sets that incoming kindergarten children need and the skills that they will master in kindergarten have also increased (Bassok, Lathan, & Rorem, 2016). For example, a recent national survey showed that a majority of teachers (80%) now expect children to learn to read in kindergarten, whereas only 31% did so in 1998 (Bassok et al., 2016). Kindergarten teachers also value the social-emotional skills needed for school success, with over 75% listing skills such as

following directions, taking turns, sharing, and paying attention as critical kindergarten readiness skills (Bassok et al., 2016, Curby et al., 2017).

Interestingly, parallel to increases in ECE attendance and kindergarten expectations, fundamental shifts have occurred in the conceptualization of school readiness. These shifts extend beyond the increased expectations mentioned previously and represent important changes in our understanding of the nature of the developmental processes that support children's readiness to succeed at school. Initial interest in school readiness and its assessment emerged in the late 1980s through the early 1990s (Snow, 2006). The measures developed then generally reflected a maturationist perspective that was common at the time that focused on determining whether children had sufficient maturity to manage the demands of formal schooling. Implicit in this conceptualization of school readiness was the notion that children who lacked readiness would not be well-served by schools. In their review of school practices at the time, Prakash et al. (2003) found that a number of schools used kindergarten-wide screening to make determinations about deviations in the age limits for school entry, with 13% of the schools surveyed using screening to accelerate the early entry of children who were younger than the chronological entry age, and 27% of the schools using screening to delay the entry of unready children who met the chronological entry age.

By the early 1990s, schools and policy-makers began to move away from this maturationist perspective. Importantly, the National Education Goals Panel (NEGP) report of 1992 identified school readiness as a transactional process involving schools that were ready for children, children who were ready for schools, and parents and communities that could support the child's developmental process (Zuckerman & Halfon, 2003). Rather than assuming school readiness emerges as a product of maturation within the child, this conceptual model focused on

the important role that schools, parents, and communities play in providing children with the high-quality support and learning opportunities that build their competencies and fuel their educational success. The NEGP also moved away from a unitary conceptualization of school readiness (e.g., a child is or is not ready) to a description that focused on skill development in multiple domains.

By the early 2000s, policy-makers had identified school readiness skills as an important outcome of ECE programs, noting that effective ECE programs should improve child skills at kindergarten entry across multiple domains (Snow, 2006). This focus had compelling longitudinal evidence to support it in two ways. First, accumulating evidence documented that school readiness is quite malleable and is enhanced when children experience high-quality ECE programming. Second, longitudinal research also demonstrated significant links between kindergarten skills with educational success many years later, suggesting that the ECE promotion of early skills had value for later educational attainment (Yoshikawa et al., 2013),

This contemporary conceptualization of school readiness is reflected in the current Head Start definition and approach (Administration for Children and Families, 2018), where school readiness is defined by the skills, knowledge, and attitudes that children possess that fuel their future school success and later learning. Schools and families working together are responsible for providing the opportunities and support for learning that children need to attain those skills, knowledge, and attitudes. Head Start also identifies five key domains for skill development, each contributing to school readiness: 1) social-emotional development; 2) approaches to learning; 3) language and literacy; 4) cognition; and 5) perceptual, motor, and physical development. This overarching framework is intended to support the provision of comprehensive child development and family engagement services that lead to school readiness for young children.

The shifting conceptualization of school readiness and the increased public interest and investment in ECE have been fueled by the developmental neuroscience research that has emerged during the past two decades. This research has informed our understanding of how early brain development supports school success, and how early childhood experiences affect early brain development.

### **Developmental Neuroscience, the Impact of Adversity, and Implications for ECE**

One well-established finding from developmental research is that a significant gap exists in the kindergarten skill-sets of children from families with less versus more socio-economic advantage (Reardon, 2011). Growing up in poorly-resourced, economically-disadvantaged environments puts children at risk for compromised development in many areas, including key domains that support school success such as social-emotional adjustment, language skills, and cognitive development (Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005). In addition, children who start kindergarten with delays in these skill areas are at elevated risk for ongoing school difficulties, including the delayed acquisition of math and reading skills, as well as social and behavioral maladjustment, especially when children are placed in poor-quality classrooms at school entry. Overall, the gaps associated with family socio-economic disadvantage do not diminish over time, resulting in long-term disparities in academic achievement, graduation rates, and subsequent employment and well-being (Reardon, 2011).

Advances made in developmental neuroscience research have helped to clarify some of the reasons for these long-term effects of poverty on adaptive development and school attainment. Children growing up in poverty are typically exposed to a host of adverse experiences. These include elevated levels of family mobility and instability, crowded and sometimes unsafe living conditions, chronic stressors, lack of resources, and chaotic,

unpredictable home environments, which have shown negative associations with children's social-emotional and cognitive development (Guo & Harris, 2000). Adverse conditions and elevated stress often undermine effective parenting, reducing opportunities for the kind of predictable, sustained, positive interactions with caregivers that promote positive social-emotional, language, and cognitive development (Evans et al., 2005). In addition, low-income families have limited resources, including both less education and less access to high quality child-care and schools compared to more advantaged families (Evans et al., 2005; Masten & Labella, 2016; McLoyd, 1998).

Emerging developmental neuroscience research suggests that exposure to early adversity often undermines the development of key neural structures that support children's capacity for learning. This research has focused specifically on the early development of executive function (EF) skills. EF skills involve a complex set of cognitive processes that help children organize their thinking and behavior with intention and flexibility. They include working memory (e.g., being able to hold information in mind and manipulate it mentally), attention control skills (e.g., being able to focus selective attention, avoid distractibility), and inhibitory control (e.g., being able to resist impulsive reactions and plan behavioral responses), all of which enhance goal-oriented learning and problem solving (Hughes & Graham, 2002). These skills develop rapidly during the preschool and early elementary years (ages 3-7) and provide the neural architecture that supports school readiness, by increasing children's abilities to control their behavior and engage in goal-oriented learning (Blair & Raver, 2015). At school entry, higher levels of EF skills promote the acquisition of reading and math skills (Welsh, Nix, Blair, Bierman, & Nelson, 2010). EF development is often delayed among children growing up in poverty (Noble, McCandliss, & Farah, 2007). Researchers believe that exposure to the chronic stressors that

characterize poverty in early childhood overloads stress responses in ways that increase impulsive responding and impede the development of the EF skills that enhance adaptive coping (Blair & Raver, 2015). The impact is associated with delays in the development of the learning behaviors that support academic achievement, reflected in low levels of classroom engagement and elevated teacher-rated attention problems (Bodovski & Youn, 2011).

Fortunately, EF skills are malleable, and evidence is accumulating to show how early intervention and high quality ECE can remediate or reduce the negative impact of poverty on EF development (Bierman & Torres, 2015; Diamond & Lee, 2011). Combined, this research illustrates the critical need to focus on improving ECE and increasing access to high-quality ECE for all children, and especially for children whose early development may otherwise be compromised by adverse experiences and inadequate positive developmental support.

In the next sections of this chapter, we describe how this developmental research along with policy-maker pressures for accountability have increased interest in the impact that different approaches to ECE have on child school readiness outcomes. Emerging research focused on documenting the child outcomes associated with different kinds of preschool experiences has illuminated new directions for ECE programming with promise for strengthening child school readiness and reducing the gaps associated with family socio-economic disadvantage.

### **An Emerging Focus on Child Outcomes to Assess ECE Quality**

A strong research base supports the link between the quality of ECE programming and its benefits for children (Brown, Scott-Little, & Wynn, 2007). At the same time, there is considerable debate about how best to measure ECE quality and about the degree to which different aspects of ECE quality are related to child school readiness outcomes (Pianta, Barnett, Burchinal, & Thornburg, 2008). Over the past two decades, research on this topic has

accelerated. In light of the increasing levels of public investments in ECE, policy-makers want to assure that funded ECE programs are preparing children adequately for success in school and reducing the socio-economic gap in school readiness at kindergarten entry (Brown et al., 2007). Research that examines associations between different aspects of ECE program quality and child school readiness has focused primarily on the preschool years (ages 3-6) with the goal of determining the types of ECE programming that might optimize child success at kindergarten entry.

One domain of quality measurement involves the organizational or structural characteristics of ECE programs such as the level of teacher training, class size, child-teacher ratio, building safety and resources, and general routines of daily programming (Pianta et al., 2008). A second domain of quality measurement focuses on the process characteristics of ECE programming, which involve the nature of interactions between caregivers and children and the way that these interactions support positive learning experiences for children (Pianta et al., 2008). Research comparing associations of ECE structural and process characteristics with child outcomes suggest that process characteristics are of particular importance for boosting school readiness outcomes, whereas structural characteristics appear important primarily as facilitators of high-quality process (Pianta et al., 2008). That is, teacher education and training, class size, and adult-child ratios are of benefit primarily when they foster stimulating and sensitive adult-child interactions that support emotional and cognitive development. It is the provision of high-quality teacher-child interactions including sensitive-warm interactions, instruction and conversation, and responsive feedback that show consistent associations with more positive language, academic, and social-behavioral child outcomes in ECE programs (Mashburn et al., 2008).



Although critically important, process measures of classroom quality remain limited in terms of their capacity to predict and promote child school readiness outcomes. For example, Burchinal and colleagues (2009) conducted a large meta-analysis of program quality features and their associations with child outcomes. Important and statistically significant associations emerged, but were modest in level, suggesting that the quality of caregiver-child interactions is one factor promoting child development in ECE settings, but that other factors also contribute. Emerging research suggests that, in addition to high-quality teacher-student interactions, intentional instruction may enhance the school readiness of preschool children.

As noted previously, contemporary conceptualizations of school readiness are multi-dimensional, recognizing the importance of skill acquisition in multiple domains for school success. Accumulating research suggests high-quality preschool instruction is multi-dimensional as well, with instruction in specific content areas promoting enhanced skill acquisition in the corresponding school readiness domain (Pianta et al., 2008). Accordingly, efforts to improve child school readiness may hinge on revising and improving the curriculum content of preschool programs as well as promoting high quality teacher-student interactions, using evidence-based curriculum components, and providing focused professional development support to help teachers implement this programming with high fidelity in the context of positive, responsive teacher-child interactions (Jenkins & Duncan, 2017; Nguyen, Jenkins, & Whitaker, 2018).

Currently, Head Start and many state prekindergarten programs require the use of a whole child curriculum that is not domain-specific, but rather guides teachers in applying a developmental-interaction approach to support learning across multiple domains (Nguyen et al., 2018). Based on a 2012 national survey, the most commonly used whole child curricula are Creative Curriculum for Preschool and HighScope Curriculum (Jenkins & Duncan, 2017). In

contrast, content-specific or targeted curricula are designed to increase children's exposure to intentional and explicit learning opportunities in specific content domains, such as math (Clements & Samara, 2007), literacy (Wasik & Hindman, 2011), or social-emotional learning (Bierman & Motamedi, 2015). These content-specific curricula involve sequenced instruction embedded in stories, games, and activities that progress across the year, building a foundation for within-domain learning with simpler activities at the start of the year that are built on and expanded upon over the course of the year. Teachers are provided with detailed lesson plans and, in the more successful programs, also receive extensive professional development support and coaching in optimal implementation and teaching strategies. As described in more detail in the following sections of this chapter, enriching preschool programs with evidence-based content-specific curriculum components and associated professional development support is proving effective in boosting child school readiness outcomes in a number of core domains.

In the next sections, we identify several model preschool programs that have proven effective in boosting child school readiness in three of the five domains of school readiness identified by Head Start: 1) language and literacy skills, 2) cognition and numeracy skills, and 3) social-emotional development. In each domain, we highlight a few programs that have strong scientific evidence of efficacy, as documented by randomized-controlled trials. For more comprehensive reviews, see Callaghan and Madelaine(2012) and Hall, Simpson, Guo, and Wang (2015) for language and literacy skill programs, Clements and Samara (2011) for cognition and numeracy programs, and Bierman and Motamedi (2015) for social-emotional learning programs.

### **Exemplar Targeted Preschool Curricula Promoting School Readiness Skills**

**Language and literacy skills.** Opening the World of Learning (OWL; Schickedanz & Dickinson, 2005) is a good example of a targeted preschool curriculum designed to enrich

language use in preschool classrooms and provide sequenced learning opportunities that promote emergent literacy skills (Ashe, Reed, Dickinson, Morse, & Wilson, 2009). The full-day programming is divided into teacher-directed and child-initiated activities that are oriented around 1) vocabulary and conceptual learning and 2) code-related learning, both of which contribute in critical ways to establishing later reading skills (Storch & Whitehurst, 2002). In daily Morning Meetings, teachers name and demonstrate with objects that are made available for Center Times, during which child-directed and play-based learning reinforces conceptual knowledge. This is followed by Storybook Time, an interactive instruction format that utilizes repeated exposures of three to four readings to facilitate mastery of new vocabulary and content. As children become familiarized with key words, teachers foster engagement and comprehension by prompting children to help reconstruct story events and read the book using their own words. In Small Group time, teachers lead activities that reinforce previously explored concepts. The Songs, Wordplay, and Letters component of the curriculum teaches phonological awareness, vocabulary, and letter knowledge through engaging, play-based activities. Finally, group discussions focus either on exploring social and emotional issues or introducing conceptual knowledge through short book reading.

Children who participated in OWL classrooms had significantly improved oral language and code-related skills by the end of preschool and were performing on par with the national average on standardized reading achievement tests in first grade relative to classmates who had not participated in the program (Weiland & Yoshikawa, 2013). Similar gains were found for ethnically diverse, English-language learning, and special needs students (Wilson, Dickinson, & Rowe, 2013; Weiland, 2016). Critical elements to the success of the OWL intervention include strong support for professional development, in-class coaching for teachers, and a curriculum

that emphasizes mastery of vocabulary and conceptual knowledge and code-related literacy skills through intentional instruction as well as interactive games (Wilson et al., 2013). Additionally, OWL espouses a classroom interaction style that is characterized by high-quality student-teacher interactions, fostering engaged and flexible responsiveness to individual student needs.

A second example of an evidence-based targeted preschool curriculum promoting language and literacy skills is the Exceptional Coaching for Early Language and Literacy (ExCELL) program. ExCELL is an intensive professional development intervention that trains teachers to promote preschool language development in five domains: interactive book reading, guiding conversations, phonological awareness, alphabet knowledge, and writing (Wasik, 2010). During interactive book reading, teachers ask open-ended questions, define target vocabulary using child-friendly language, and scaffold language learning by drawing connections between words introduced in book reading and their application in other classroom activities (Wasik, Bond, & Hindman, 2006). Teachers are also coached in implementing classroom materials such as story-related props, picture and word cards, and games that naturalistically reinforce target vocabulary in the context of engaging, play-based extension activities used throughout the day in centers and during free play.

In the ExCELL intervention model, conversational support plays a central role in facilitating child mastery of conceptual, vocabulary, and code-related knowledge. Teachers are coached in the use of several key conversational strategies that research has linked with gains in child language and literacy development (Wasik & Hindman, 2011; 2014). For example, teachers are encouraged to make frequent references to target vocabulary words, providing explicit word labels in conversations with students and during activity-related discussions in order to model the use of new vocabulary words in broad contexts outside of book reading.

Additionally, teachers encourage language production by using open-ended questions to initiate conversations, which they extend by building upon children's responses. This is also accomplished by using active listening to respond to child comments, and expanding upon the child's utterances. Specifically, teachers are coached to respond to children's simple responses by elaborating upon them, including additional vocabulary and expanded grammatically correct sentences. Teachers who completed the ExCELL professional development program were found to have high quality, language-rich classroom environments that facilitated significantly greater gains in students' receptive vocabulary and code-related skills compared to usual practice comparison classrooms (Wasik & Hindman, 2011).

**Cognition and numeracy.** Parallel to the emergence of targeted preschool curricula that promote language and literacy skills, mathematics-focused curricula have emerged that promote gains in preschool cognitive reasoning and numeracy skills. A few examples of recent evidence-based mathematics curricula, along with their key findings and primary program components, are presented here.

One of most widely used evidence-based curriculum targeting mathematics is Building Blocks Pre-K (Clements & Sarama, 2007). This program organizes lessons around topics of interest to young children and utilizes small group games and activities, along with computer-based games and activities to support the development of 1) spatial and geometric competencies and concepts, and 2) numeric and quantitative concepts. There are three mathematical subthemes: patterns and functions, data, and discrete mathematics (classifying, sorting, and sequencing). For example, in the numeracy domain, children learn to compare amounts of different objects and combine objects to increase amounts using simple nonverbal addition games and manipulable objects. Lessons are sequenced, so that these basic activities progress

gradually from more basic to more advanced math skills, such as counting objects and doing simple addition. This developmentally-sequenced curriculum is based on well-defined learning progressions and has been shown to be more effective at increasing children's number and geometry skills than usual practice comparison preschool classrooms (Clements & Sarama, 2007).

The effectiveness of Building Blocks has been tested with two randomized-controlled trials (Clements & Sarama, 2007, 2008). In these studies, Building Blocks proved more effective than the usual practice curriculum in promoting children's mathematical knowledge and reasoning skills. Interestingly, Building Blocks also promoted gains in letter recognition and oral language skills (Samara, Lange, Clements, & Wolfe, 2012), and the authors hypothesized that strengthening children's conceptual skills enhanced their learning engagement and thereby promoted cross-domains gains in emergent literacy skills along with the direct effects on mathematical skills.

A second example of an evidence-based preschool curriculum targeting numeracy skills is Big Math for Little Kids (BMLK; Lewis Presser, Clements, Ginsburg, & Ertle, 2015). BMLK was developed based on a developmental progression in which preschool children acquire an intuitive sense of mathematics concepts and operations skills even before they can describe their reasoning in words. The program provides sequenced math lessons that utilize play, games, stories, and other engaging children's activities to elicit children's excitement about doing math. The 32-lesson curriculum consists of units that focus on number, shape, patterns/logic, measurement, number operations, and spatial relations and is organized so the same activities are repeated with increasing difficulty over a few days. A randomized-controlled trial demonstrated that children who attended child-care programs using BMLK compared with child-care programs

using their usual practice curriculum showed increased Early Childhood Longitudinal Study–Birth Cohort (ECLS-B) mathematics assessment scores in kindergarten, gaining the equivalent of an additional 2.9 months of instruction (Lewis Presser et al., 2015).

A third preschool curriculum targeting math is Pre-K Mathematics, developed by Starkey, Klein, and Wakeley (2004). Based on developmental research documenting processes of mathematical knowledge acquisition during the preschool years (ages 3-5), Pre-K Mathematics combines closely-related content into units. The seven units which together include 27 small-group activities, are sequential in nature: Enumeration and Number Sense, Arithmetic Reasoning, Spatial Sense, Geometric Reasoning, Pattern Sense and Unit Construction, Non-Standard Measurement, and Logical Relations. Teachers follow detailed lesson plans to teach concepts using concrete materials during small-group instruction, computer-based mathematics activities, and mathematics learning centers. This curriculum was shown to be effective at promoting mathematics knowledge in a randomized control trial conducted in 40 Head Start classrooms. Children in classrooms that implemented the intervention showed greater gains in mathematics knowledge compared to children in classrooms that used typical mathematics curriculum as evidenced by significantly higher scores on the Child Mathematics Assessment (CMA) at the end of the year (Klein, Starkey, Clements, Sarama, & Iyer 2008).

Finally, a fourth program warrants mention, as it represents a somewhat different approach to mathematics lesson than the other programs mentioned in this section. The technologically-oriented Math-Shelf program (Schacter & Jo, 2016) uses a Montessori method approach to teaching mathematics concepts. The program is delivered on an iPad, with the rate of progression tailored to each child's knowledge level and response, thereby personalizing math instruction. Children play a series of games that teach different sequenced mathematics concepts

(for example, small quantities and one-to-one counting in first set of games, all the way to place value and quantities from 20-100 if mastery is demonstrated.) In a randomized trial, children using this curriculum learned more over the preschool year than children who participated in their regular mathematics curriculum (Schacter & Jo, 2016).

**Social-emotional development.** Targeted curricula have also been developed to target social-emotional skill development in the preschool years. Social-emotional skills are a central component of school readiness (Bassok et al., 2016). Important preschool skills include getting along and cooperating with others, understanding and managing strong feelings, and solving every day interpersonal problems. These skills deserve focused attention during the preschool years, because they are critical for long-term school and life success (Bierman & Motamedi, 2015; Jones, Greenberg, & Crowley, 2015).

A well-studied example of a content-specific curriculum designed to promote social-emotional learning is the *Preschool PATHS Curriculum* (Domitrovich, Greenberg, Cortes, & Kusche, 1999). Preschool PATHS targets four domains of preschool social-emotional skills: 1) friendship skills and prosocial behaviors (e.g., helping, sharing, taking turns), 2) emotional knowledge (e.g., recognizing and labeling core feelings), 3) self-control (e.g., using the Turtle Technique that guides children when distressed to “tell yourself to stop, take a deep breath to calm down, say the problem and how you feel”), and 4) social problem-solving. There are 33 brief (15-20 minute) lessons with stories, pictures, and puppets that provide skill instruction, designed for use during circle time, 1-2 times per week. Teachers introduce and illustrate skill concepts with puppets, pictures, and story examples. Each lesson includes ideas for formal and informal extension activities that teaching staff can use throughout the day to generalize key concepts. For example, the emotion lessons use photographs, stories, and feeling face cards to



help children learn to identify and label feelings verbally in order to manage them. Teachers are also encouraged to provide emotion coaching throughout the day, modeling feeling statements themselves when appropriate, helping children notice the feelings of peers, and prompting children to describe their own feelings. Teachers are also encouraged to watch for naturally occurring teachable moments, such as peer disagreements or conflicts. At these times, teachers are taught to help children stop and calm down (using Turtle Technique) and then talk through the problem-solving steps of defining the problem and their feelings, listening to their friend's feelings, and generating ideas for how to solve the problem.

Several randomized trials provide evidence of the efficacy of Preschool PATHS. In the first study, 20 Head Start classrooms were randomized to the intervention (Preschool PATHS) or a usual practice control group; 287 children were followed for 1 year, with skills assessed at the start and end of the year. By the end of the year, children who received Preschool PATHS classrooms out-performed children in the control group on measures of emotion knowledge and emotion recognition skills, and on teacher and parent ratings of social competence (Domitrovich, Cortes, & Greenberg, 2007). In a second study, Preschool PATHS was combined with MyTeachingPartner, a web-based professional development program (MTP, Hamre, Pianta, Mashburn, & Downer, 2012). Prekindergarten teachers in 233 classrooms were randomly assigned to one of three conditions: 1) PATHS-High, which included the Preschool PATHS curriculum, access to demonstration videos and MTP coaching; 2) PATHS-Low, which included the Preschool PATHS curriculum and access to demonstration videos, but no MTP coaching; and 3) usual practice control. Relative to the usual practice control group, children in both of the other conditions who received Preschool PATHS showed significantly greater improvements in teacher-rated social competencies (frustration tolerance, assertiveness skills, task orientation,

social skills). Finally, Preschool PATHS was evaluated in the context of a national randomized study, the Head Start CARES project. It produced heightened levels of emotion knowledge and social problem-solving skills, and improved social competence as rated by teachers as well as stronger learning behaviors (Morris et al., 2014).

### **Future Directions: Implications for Practice and Research Needs**

Accumulating research provides strong evidence for the value of high-quality ECE programming in promoting early child skill development and fostering school readiness (Yoshikawa et al. 2013). ECE programming that includes warm, responsive, and intellectually stimulating teacher-child interaction and that utilizes evidence-based skill-focused curricula appears particularly useful in fostering school readiness skills and closing the gap in school readiness associated with family socioeconomic disadvantage. At the same time, there are important challenges for the future.

There are research needs. Although targeted curricula have proven effective in promoting child skills in specific domains such as literacy, numeracy, and social-emotional skills, it remains a challenge to integrate multiple domain-specific curriculum into a cohesive program. A few model studies have illustrated the power of combining two targeted curricula. For example, the Boston Pre-K study used a combination of OWL and Building Blocks PreK. Program evaluation demonstrated positive gains for children in the targeted areas of emergent literacy and numeracy skills, along with gains in EF skills (Weiland, 2016; Weiland & Yoshikawa, 2013).

In another example, the Head Start REDI program also combined two targeted curricula, using the Preschool PATHS Curriculum integrated with a literacy intervention that utilized interactive reading, sound games, and alphabet center activities. A randomized trial comparing REDI to usual practice Head Start showed increases in social-emotional skills (emotional

understanding, social problem-solving), improvements in emergent literacy skills, and gains in approaches to learning (observed learning engagement and EF skills; Bierman, Domitrovich et al., 2008; Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008). These studies suggest that two targeted preschool curricula can be combined effectively with positive impact on child outcomes relative to using the kind of whole child curriculum typically used in Head Start and other programs. However, it seems unlikely that implementing five separate curricula that target the five domains of school readiness would be effective, due both to the practical implementation challenges (e.g., finding time to implement five curriculum programs, managing the teacher burden of learning and implementing five programs with fidelity) and the likelihood that this level of curriculum focus would over-structure the preschool day, undermining teacher's abilities to remain flexible, spontaneous, and child-focused in their program delivery.

Luckily, it does not appear necessary to target all five domains with distinct curricula as emerging evidence suggests cross-domain gains in skill acquisition. For example, the Boston Pre-K study and Head Start REDI project documented improvements in approaches to learning without targeting EF skills or learning engagement directly. In contrast to the domain-specific content areas, such as literacy, numeracy, or social-emotional skills, approaches to learning reflects domain-general skills (attention, memory, inhibitory control) that affect the pace and quality of children's learning capacity across domains. Hence, these skills may benefit from evidence-based curriculum targeting emergent literacy, numeracy, and/or social-emotional skills. Positive effects on EF have also been documented using intervention approaches that focus on promoting positive classroom management and teacher-student interaction quality (Raver et al., 2011; Raver et al., 2009). However, additional research is needed to explore programming that integrates multiple targeted curricula in order to understand better the scope of their effects.

In addition, programming that may foster physical and motor development has garnered relatively little attention. Yet, there is some evidence that certain kinds of physical programming in preschool can promote cross-domain gains in other areas of school readiness as well. For example, Lobo and Winsler (2006) conducted a randomized trial of an 8-week dance program and found positive effects on teacher and parent ratings of child social competence and reduced levels of internalizing and externalizing problems. In another study, Schmitt, McClelland, Tominey, and Acock (2014) found that children attending Head Start who were randomly assigned to an 8-week games program showed greater increases in EF skills than children in the comparison group. These studies suggest that certain kinds of strategic physical activity programs may foster physical skill development and, at the same time, promote gains in other skill areas such as social-emotional competence and approaches to learning. More research in this area is definitely warranted.

In each of the studies described in this chapter, targeted preschool curricula provided teachers with two types of intervention support that likely each contributed to the benefits observed in child school readiness. These two ingredients were: 1) lesson plans that laid out sequenced and intentional learning opportunities for children in specific skill domains provided in the form of engaging stories, games, and activities; and 2) professional development and supportive coaching for teachers to help them deliver programming using positive management strategies and with high-quality teacher-student interactions. A key goal for the future is the scaling up of these kinds of model programs to make them more widely available for diverse ECE programs and program staff.

It is also important to note that, although this chapter has focused primarily on how ECE programs can support child school readiness, families play a critical role as well. Child school

readiness benefits when parents support early learning at home by engaging in frequent warm and responsive interactions, talking and reading with children, and introducing learning games and activities (Fantuzzo, McWayne, Perry, & Childs, 2004). For children in Head Start, this kind of home-based family involvement is a strong predictor of multiple dimensions of school readiness, including language development, approaches to learning, and social-emotional school readiness (Fantuzzo et al., 2004). Correspondingly, parent-focused interventions have proven effective in boosting the school readiness of low-income preschool children, adding to the benefits of participation in high-quality ECE. Positive approaches have included the use of parent groups to support positive parent-child interaction and behavior management skills, home routines, and home-school communication (Brotman et al., 2013) and teaching parents to use interactive reading strategies and play learning games at home in ways that are coordinated with center-based ECE (Bierman, Heinrichs, Welsh, Nix, & Gest, 2017). Further research on these kinds of parent support programs is needed, particularly with a focus on scalability and broad diffusion potential.

Finally, additional research is needed to understand better how to promote the sustainability of preschool benefits after children transition into elementary school (Bailey, Duncan, Odgers, & Yu, 2017). Aligning curricula across the prekindergarten to elementary school gap, using parents more effectively as transition supports, and providing booster interventions after the transition have all been suggested as strategies that might maximize the boost to child school success provided by a high-quality ECE program.

## **Summary**

In recent years, ECE programming has become a common interest of educators, policy-makers, and the public at large. Increasing numbers of U.S. children are attending center-based

ECE programs, and accumulating developmental research suggests that the quality of those ECE experiences can have a long-term impact on child school success and future well-being, particularly for children who face early socio-economic disadvantage and heightened exposure to adversity. This chapter focused on the shifts that have occurred in the past two decades in the conceptualization of school readiness and the corresponding focus on identifying ECE programming that optimizes child school readiness outcomes. To boost child school readiness outcomes, future efforts need to focus on supporting the widespread diffusion of evidence-based ECE programming that includes the two critical features of sequenced lesson plans providing intentional learning opportunities for children in specific skill domains, and supportive coaching for teachers to enhance high-quality teacher-student interactions and high-fidelity program implementation. Ongoing research is also needed to inform the continued expansion and refinement of school-based and family-focused strategies that can optimize school readiness for all children.

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