Early Childhood Research Quarterly 26 (2011) 42–49

Contents lists available at ScienceDirect

Early Childhood Research Quarterly

Schooling effects on preschoolers' self-regulation, early literacy, and language growth☆

Lori E. Skibbe[a,*], Carol McDonald Connor[b], Frederick J. Morrison[c], Abigail M. Jewkes[d]

[a] Michigan State University, Family & Child Ecology, 7 Human Ecology, East Lansing, MI 48824, United States
[b] Florida State University, Florida Center for Reading Research, United States
[c] University of Michigan, Department of Psychology, United States
[d] Hunter College of the City University of New York, School of Education, United States

ARTICLE INFO

Article history:
Received 21 August 2007
Received in revised form 3 May 2010
Accepted 11 May 2010

Keywords:
Schooling
Literacy
Self-regulation
Vocabulary

ABSTRACT

The present study examined the influence of schooling during children's first and second years of preschool for children who experienced different amounts of preschool (i.e., one or two years), but who were essentially the same chronological age. Children ($n = 76$) were tested in the fall and spring of the school year using measures of self-regulation, decoding, letter knowledge, and vocabulary. Using hierarchical linear modeling (HLM), preschool was not associated with children's development of self-regulation in either year. For decoding and letter knowledge, children finishing their second year of preschool had higher scores, although both groups of children grew similarly during the school year. Thus, our results suggest that the first and second years of preschool are both systematically associated with decoding and letter knowledge gains, and the effects are cumulative (two years predicted greater gains overall than did one year of preschool). Finally, children's chronological age, and not whether they experienced one versus two years of preschool, predicted children's vocabulary and self-regulation outcomes. Implications for preschool curricula and instruction are discussed, including the increasing emphasis on literacy learning prior to kindergarten entry and the need to address self-regulation development along with academic learning.

1. Schooling effects on preschoolers' self-regulation, early literacy, and language growth

As more attention is focused on children's readiness to begin kindergarten (Justice, Bowles, Pence Turnbull, & Skibbe, 2009; Rimm-Kaufman, Pianta, & Cox, 2000), it becomes increasingly important to understand the unique effect of preschool on children's school readiness. School readiness generally refers to aspects of children's social and academic development that are associated with children's preparedness for formal schooling (De Feyter & Winsler, 2009); this includes emotional maturity and social competencies, such as self-regulation, as well as general knowledge, cognitive ability, and language development (Boethel, 2004; Duncan et al., 2007; Pianta, 2002). Increasing numbers of children are currently attending preschool (57% of three- to five-year olds in 2005; Child Trends Databank, 2006), however, according to a national survey of kindergarten teachers, as many as half of students enter kindergarten without the necessary academic or social skills needed to succeed (Rimm-Kaufman et al., 2000). As such, policymakers and parents often debate about when to place children into kindergarten classrooms (Stipek, 2002, 2006).

Many developmental changes occurring during early childhood appear to be driven by maturation, rather than specific aspects of the environment (e.g., see Kagan, 1984). Nonetheless, a wealth of research has indicated the importance of investigating contexts of learning when documenting changes in children's development (e.g., Alexander, Entwisle, & Olson, 2007; Morrison, Smith, & Dow-Ehrensberger, 1995). We present findings from a study of young children's development in order to more closely examine the role of preschool on children's academic and social development. Specifically, we examine how varying amounts of preschool (i.e., one year versus two) relate to growth in self-regulation, literacy skills, as measured by decoding and letter knowledge, and language, as measured by vocabulary. There has been a recent increase in universal preschool in many states, primarily as a way to address the vast differences observed among children upon kindergarten entry (Lee & Burkam, 2002). Notably, academic achievement in kindergarten

☆ This work was supported by the National Institute of Child Health and Human Development and the National Science Foundation under grant numbers R01 HD27176 and 0111754, respectively. Additional funding was provided by the U.S. Department of Education, Institute for Education Sciences, Cognition and Student Learning (R305H04013) and the National Institute of Child Health and Human Development (R01 HD48539).

* Corresponding author.
E-mail address: skibbelo@msu.edu (L.E. Skibbe).

0885-2006/$ – see front matter © 2010 Elsevier Inc. All rights reserved.
doi:10.1016/j.ecresq.2010.05.001

has been linked to longer preschool programs for children living in low-income neighborhoods (Reynolds, 1995). The current work expands upon these previous findings to investigate how the number of years spent in a preschool program relates to self-regulation, literacy, and language development skills, which are thought to prepare children for success in kindergarten, while controlling for children's chronological age.

1.1. Self-regulation in preschool

Measures of self-regulation have been linked to children's concurrent as well as future academic success (Blair, 2002; Howse, Lange, Farran, & Boyles, 2003; McClelland & Morrison, 2003; McClelland, Acock, & Morrison, 2006; McClelland et al., 2007). Variability in self-regulation can be documented in preschool (McClelland & Morrison, 2003) and represents a key aspect of school preparation in early childhood (Bodrova & Leong, 2006; Bronson, 2000; Shonkoff & Phillips, 2000).

Although there is some debate about the nature of early self-regulation (see Ponitz et al., 2008, for a discussion), we view self-regulation as a set of behaviors that includes attention, working memory, and inhibitory control. Self-regulation is related to children's behavioral social skills, as measured by the *Child Behavior Rating Scale* (Bronson, Tivnan, & Seppanen, 1995) and, in preschool, it is possible to teach children to engage in inhibitory control activities successfully, an important component of self-regulation (Dowsett & Livesey, 2000).

Teachers' focus on many skills associated with self-regulation, such as following directions and classroom routines, paying attention, standing in line, and sitting properly, is associated with self-regulation gains, although the degree to which teachers actively emphasize these activities appears to vary widely, at least in first grade (Cameron, Connor, & Morrison, 2005). In preschool, children may be introduced to the rules and routines of formal schooling in ways that are less explicit than in later grades (Campbell & Ramey, 1995; Dickinson, Anastasopolous, McCabe, Peisner-Feinberg, & Poe, 2003) and, although self-regulation was not measured specifically, a recent report found that one preschool program, Head Start, was not associated with positive gains in social skills for three- and four-year-old participants (Administration for Children & Families, 2005). As self-regulation is closely related to some social skills, it is unclear whether more time spent in a preschool classroom would facilitate growth in this skill set, even though programs that focus on self-regulation explicitly demonstrate potential for boosting young children's skills in this area (Bodrova & Leong, 2006). The current study examines how the number of years spent in preschool (one year versus two) for children who are the same chronological age relates to their growth in self-regulation during this same period of time.

1.2. Early literacy in preschool

In addition to self-regulation, early literacy skills are essential for developing proficient reading and writing skills as well as overall success in school (Teale & Sulzby, 1986; Whitehurst & Lonigan, 1998). Proponents of preschool argue that early exposure to text and print concepts support literacy development and result in long-term academic success (Barnett, Young, & Schweinhart, 1998; Bryant, Peisner-Feinberg, & Clifford, 1993; Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002; Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001). The current study focuses on two areas of development related to early literacy development during preschool: decoding and letter (or alphabet) knowledge.

Links between letter knowledge and school success are well documented, because letter knowledge is one of the strongest early predictors of later reading proficiency (Catts & Kamhi, 2004; Catts, Fey, Zhang, & Tomblin, 1999). Similarly, children begin to understand the graphological features of written language, an early decoding skill, even before preschool (van Kleeck, 1998). When compared to other factors associated with early reading development, early print knowledge explains much of the variance in later reading performance ($d = .47$; Hammill, 2004) and is heavily emphasized in high-quality preschool classrooms (Justice, McGinty, Guo, & Moore, 2009; Pianta, 2007).

1.3. Early language development

Vocabulary is also an important factor to consider when examining children's school readiness, as early development in this area has been found to predict word recognition skills (NICHD Early Child Care Research Network, 2005). Although vocabulary often contributes to children's academic achievements (e.g., Catts, Fey, Zhang, & Tomblin, 2001), the precise role of children's early schooling experiences to growth in this area is not clear (National Early Literacy Panel, 2008). When compared to other aspects of language and literacy development, vocabulary is not often emphasized directly in kindergarten classrooms (Juel, Biancarosa, Coker, & Deffes, 2003) and, at least for older children, some studies have concluded that time spent in school is not related to additional growth in vocabulary (Christian, Morrison, Frazier, & Massetti, 2000; Morrison et al., 1995). It has been suggested that preschoolers may not need direct instruction to learn new vocabulary words within their classrooms, but may learn new words through their play experiences (Connor, Morrison, & Slominski, 2006). Also, preschoolers may rely heavily on their home environment to learn new vocabulary words (Hood, Conlon, & Andrews, 2008; Sénéchal, LeFevre, Hudson, & Lawson, 1996). For these reasons, vocabulary growth may not be associated with schooling for this age group.

1.4. School cutoff technique

As children progress through school, they are also getting older, making it difficult to disentangle how much of children's self-regulation, literacy, and language growth is due to schooling and how much simply reflects the internally driven changes that occur as children mature. Different methodological techniques have been used as a means for studying the influence of schooling on children's development, including regression-discontinuity designs (Cahan & Davis, 1987; Gormley, Gayer, Phillips, & Dawson, 2005), cross-cultural research (Geary, Bow-Thomas, Liu, & Siegler, 1996; Rogoff & Toma, 1997), and examination of children's development during the academic year versus over the summer, when children are typically not in school (Alexander et al., 2007; McCoach, O'Connell, Reis, & Levitt, 2006). The current study makes use of the school cutoff technique, which utilizes the arbitrary school cutoff dates set by each state for entry into kindergarten (Morrison, Griffith, & Frazier, 1996).

The school cutoff technique is a between-children design that places children into two groups based on whether their date of birth falls just before or just after the school cutoff date. The current study followed a sample of children with birthdates two months before or after the arbitrary cutoff date for preschool entry. Using this technique usually produces a small sample due to participation requirements; however, unlike other methodologies (e.g., cross-cultural research), it closely resembles a natural experiment, allowing for near causal interpretations. In the present study, the use of this methodology facilitates the comparison of children who had differential amounts of schooling (i.e., one or two years of preschool), but who were essentially the same age. This allows for the separation of schooling-related from age-related influences on

children's self-regulation and early literacy growth when controlling for individual characteristics, such as parental age, education, and race.

Previous research using this methodology has documented unique schooling effects across the early elementary grades for an array of academic skills, including alphabet letter knowledge (kindergarten), word recognition (kindergarten and 1st grade), number addition (kindergarten and 1st grade), general mathematical skills (kindergarten and 1st grade), memory performance (1st grade), phonemic awareness (1st grade), syllabic segmentation (2nd grade), and word reading (2nd grade) (Bisanz, Morrison, & Dunn, 1995; Morrison, Griffith, & Alberts, 1997; Morrison et al., 1996, 1995). In addition, the school cutoff technique has been used to examine growth of self-regulation, with schooling effects detected in second and third grade, using a measure of executive functioning (McCrea, Mueller, & Parrila, 1999). This analytic technique, although used with school-age children (Morrison et al., 1997, 1995), has yet to be utilized with children prior to kindergarten.

1.5. Research aims

Using a new sample of children, we examined the relations between the first and second years in preschool and the level and growth of self-regulation, early literacy skills (i.e., letter knowledge and decoding) and language (i.e., vocabulary). Given the current focus on early literacy instruction in preschool, we hypothesized that children who were starting their second year of preschool (i.e., having experienced one year of preschool) would exhibit greater decoding and letter knowledge skills compared to same-age children starting their first year of preschool. We also hypothesized that children starting their second year of preschool would display higher levels of self-regulation than same-age children starting their first year of preschool, as formal school settings may place many more behavioral demands on children than home settings, encouraging development of self-regulation skills. In contrast, we expected children of the same-age starting their first and second years of preschool to have similar vocabularies, as vocabulary is not as heavily emphasized as other skills during children's first years in school and may be supported through activities present in both home and school settings (e.g., through play). In all cases, regardless of level differences, we expected children to demonstrate similar growth across the school year in both the first and second years of preschool. That is, even though children attending their second year of preschool were preparing to make the transition to kindergarten, we expected equivalent amounts of self-regulation, literacy, and vocabulary growth during both years of preschool.

2. Method

2.1. Participants

Children ($n = 76$) were part of a longitudinal study of social and academic development in a suburban school district in a Midwest state. All children were four years of age in the fall of the study year ($M = 3.63$; $SD = .11$). The sample was divided into two sub-groups based on the district-wide cutoff date for entry into preschool, which was Dec 1st. The final sample included 46 children attending their first year of preschool (birthdates two months before or on December 1) and 30 children attending their second year of preschool (birthdates within two months following December 1). It is important to note that only one-third of children attending preschool at that time were eligible for the current study. Thus, children in this study were almost identical in age, but had different educational experiences. This between-children design allowed us to examine developmental and schooling influences separately. Children were predominately Caucasian (83%), native English speakers (95%), and from middle-to-upper-SES backgrounds. Fifty-seven percent of children were female; the proportion of males and females did not differ for children beginning their first or second year of preschool ($\chi^2 = .04$, $p = .84$). Children who were attending their first year of preschool had, on average, .65 years ($SD = 1.18$) of previous child care experiences and those attending their second year of preschool had an average 1.99 years ($SD = 2.48$) of previous experience in child care. Thus, children beginning their second year of preschool had, on average, a year more child care experiences than children starting their first year in preschool.

Table 1
A comparison of children starting their first year of preschool (1PS) to those starting their second year of preschool (2PS) on demographic variables used to compute propensity scores.

Dependent variable	1PS vs 2PS	Mean	Std. error	p
Paternal education (years)	1PS	15.69	.37	1.00
	2PS	15.69	.50	
Paternal age	1PS	40.10	1.00	.14
	2PS	36.69	1.35	
Maternal education (years)	1PS	16.21	.39	.08
	2PS	15.38	.52	
Maternal age	1PS	37.35	.75	.15
	2PS	34.75	1.01	
Child race dummy coded (1 = White; 0 = Other)	1PS	.83	.07	.71
	2PS	.81	.10	
Years in child care	1PS	.65	.26	.03
	2PS	1.99	.40	

Although the birthday cutoff date is set by the school district and thus naturally sorts children into two groups, we anticipated that there might be selection bias based on our reading of the extant literature. Using a subset of data for which we had complete demographic information ($n = 57$), we looked at these two groups of children using a multiple analysis of variance (MANOVA). The MANOVA included maternal and paternal age and education, child race, and the total years of preschool the children attended; overall, results revealed marginally significant differences between the two groups of children [Wilks Lambda = .715, $F(7, 37) = 2.11$, $p = .067$] (see Table 1).

Although group differences were small, nevertheless, they suggest some disparity between the groups. Therefore, propensity scores (Rubin, 1997) were used to equate children in the one versus two years of preschool groups. To compute propensity scores, we conducted a logistic regression using a dummy-coded variable as the outcome. A score of 1 was assigned to the one year of preschool group and a score of 0 was assigned to the two years of preschool group. The same variables used in the MANOVA were entered into the regression with means substituted for missing values. Thus, the entire sample ($n = 76$) was used in the final analyses. The propensity score is the unstandardized residual value for each child and represents the likelihood that the child, based on the variables in the model, is assigned to the one year of preschool group. For example, a propensity score of .85 would suggest that this child had an 85% chance of being assigned to the one year of preschool group (highly likely) whereas a propensity score of .24 indicates that this child had a 24% chance of being assigned to the one year group (i.e., less likely based on child characteristics). By including propensity scores in the models, we control for all of the variables included in computing propensity, but using one variable rather than using many individual variables.

2.2. Classrooms and teachers

Classrooms ($n = 42$) were part of the district-sponsored preschool program that included state-funded, Head Start, and state licensed fee-for-service options. Maximum class size was 16 and the majority (67%) of classes were part-day ($M = 12.1$ h per week; $SD = 8.48$; *range* = 5–24). A chi-square analysis revealed that children were equally likely to attend half day programs regardless of whether they were starting their first or second year of preschool ($\chi^2(76) = 2.05$, $p = .15$). Although no specific curricular approach was adopted (according to teacher and administration reports), classroom observational data indicated that activities are typical of current preschool practices (see Connor et al., 2006). Teachers were primarily Caucasian females (1 Asian) with bachelor's degrees and an average of 7.9 years of teaching experience ($M = 3.8$ years teaching preschool; $SD = 4.36$; *range* = 1–23).

2.3. Measures

Children's skills were assessed in the fall and spring of the preschool year (first or second) in a quiet location in their school using a battery of individually administered tasks that lasted approximately 30 min. For this study, we closely examined children's self-regulation, early literacy, and language skills.

Self-regulation. Children's self-regulation was assessed with the Head-to-toes Task, a direct observational measure that has been used successfully in preschool (Ponitz et al., 2008) as well as with older children (Connor et al., in press). This task measures three aspects of self-regulation thought to be important for academic success: attention, inhibitory control, and working memory. Specifically, children were asked to play a game where they were instructed to do the opposite of what the experimenter said, requiring children to remember and attend to directions while inhibiting their natural response to the examiner's instructions. For example, the experimenter instructed them to touch their head (or their toes), and instead of following the command, children were to do the opposite and touch their toes (head). Scores on this task, which range from 0 to 10, reflect the total number of correct responses out of ten items. As reported by Ponitz et al. (2008), scores on this task demonstrate good inter-rater reliability (alpha = .98 overall) and have been significantly correlated with the eight behavioral items of the *Child Behavior Rating Scale* (Bronson et al., 1995).

Early literacy development. Children's early literacy development was assessed using measures of decoding and letter knowledge. Decoding was assessed using the Letter-Word Identification subtest of the Woodcock Johnson Tests of Achievement-III (WJ-III; Woodcock & Mather, 2001). This scale requires children to name letters on a page, followed by reading words aloud. This subscale of the WJ-III demonstrates a reliability of .94 in the norming population. This test does not require text comprehension. Children's letter knowledge skills were assessed using a letter identification task. In this task, children are shown 26 shuffled lowercase letter flashcards one at a time. The number of letters named correctly provides the raw score. This task demonstrated excellent reliability (alpha = .91) and fall scores were positively and significantly correlated with spring scores ($r = .82$).

Language development. Vocabulary was measured using the Picture Vocabulary subtest of the WJ-III. As part of this subtest, children are asked to identify a set of pictures verbally. This subscale of the WJ-III demonstrates a reliability of .81 in the norming population.

3. Results

To examine differences in scores between groups and over time, we used Hierarchical Linear Modeling (HLM version 6.01; Raudenbush, Bryk, & Congdon, 2005) to partial out the shared classroom variance, which is a useful technique when children are nested in classrooms, as is the case in the present study. Descriptive statistics for each group are provided in Tables 1 and 2. In particular, it is important to note that children's age in the fall was significantly related to self-regulation ($r = .25$, $p = .03$), decoding ($r = .32$, $p = .01$), and alphabet knowledge ($r = .31$, $p = .01$) at the fall testing point, but not to vocabulary knowledge ($r = .14$, $p = .24$). Three-level repeated measure ANCOVA multi-level models were used with one of four outcomes (i.e., self-regulation, decoding, letter knowledge, and vocabulary), time (0 = fall and 1 = spring) entered at level 1, children's propensity scores and group (first year preschoolers = 1, second year preschoolers, the fixed reference group = 0) entered at level 2, and classrooms modeled at level 3 (see Eq. (1) for unconditional model). Models were built systematically starting with a fully unconditional model (i.e., no predictor variables). Overall, children demonstrated growth from fall to spring (i.e., γ_{100} was significantly greater than 0) on all four outcome measures (see Table 2).

$$
\begin{aligned}
Y_{itj} &= \pi_{0ij} + \pi_{1ij} * time_t + e_{0itj} \\
\pi_{0ij} &= \beta_{00j} + r_{00ij} \\
\pi_{1ij} &= \beta_{10j} \\
\beta_{00j} &= \gamma_{000} + u_{00j} \\
\beta_{10j} &= \gamma_{100}
\end{aligned}
\tag{1}
$$

Results of our final models, which included group and propensity scores at level 2, revealed significant differences in how children performed on all four outcome variables investigated at the fall time point. Furthermore, schooling effects for fall decoding and letter knowledge were detected, but schooling effects were not apparent for self-regulation or vocabulary (see Table 3). In Fig. 1, which displays fall and spring fitted results for self-regulation, note the two lines representing the first year preschoolers (1PS) and second year preschoolers (2PS). These two groups of children were not significantly different in the fall of the school year (suggesting that the previous first year of preschool was not associated with schooling effects) nor did they change differently (suggesting that the second year of preschool was also not associated with schooling effects).

In contrast, Figs. 2 and 3 reveal that, for letter knowledge and decoding, there were significant fitted mean differences between the two groups for fall, although growth during the year was not significantly different between the two groups. This pattern suggests children began their second year of preschool with higher scores in the fall, although the year of preschool (one versus two) was not associated with the amount of growth observed during the

Table 2
Preschoolers' fall and spring self-regulation, literacy, and language scores.

Measure	Group	Fall *M* (*SD*)	Spring *M* (*SD*)
Head-to-toes	Full sample	3.4 (3.9)	5.9 (4.0)
	1PS	2.9 (3.9)	5.4 (3.9)
	2PS	3.7 (3.9)	6.3 (4.1)
Decoding	Full sample	335.4 (25.8)	350.2 (26.9)
	1PS	325.0 (25.4)	337.3 (22.7)
	2PS	342.2 (24.0)	358.8 (26.2)
Letter knowledge	Full sample	11.1 (8.1)	16.1 (8.0)
	1PS	13.2 (8.0)	18.9 (6.4)
	2PS	7.9 (7.4)	11.9 (8.2)
Vocabulary	Full sample	466.3 (18.1)	474.3 (13.2)
	1PS	463.8 (17.9)	473.2 (10.7)
	2PS	467.9 (18.3)	475.0 (14.7)

Note. Paired sample t-tests revealed significant growth for children overall for each of the four outcome variables, $p < .001$.

Table 3
Parameter estimates for the final model for each of the four outcome variables fixed effects.

Predictor	Coefficient (SE)			
	Head-to-toes	Decoding	Letter knowledge	Vocabulary
Intercept	3.75	341.71	12.72	468.99
Effect of Group (1 PS vs 2 PS) on Fall Scores	−1.02 (1.03)	−15.42 (6.81)*	−4.04 (1.95)*	−5.66 (4.09)
Effect of Propensity Score on Fall Scores	−1.00 (2.58)	−15.14 (12.66)	−7.00 (5.67)	−4.90 (10.91)
Rate of Change from Fall to Spring (Slope)	2.24 (.66)**	14.32 (3.28)***	5.57 (.78)**	4.82 (2.31)*
Effect of Group (1PS vs 2PS) on Rate of Change	.57 (1.11)	−4.19 (5.78)	−1.45 (1.23)	6.57 (4.29)
Effect of Propensity Score on Rate of Change	−3.99 (3.22)	6.69 (9.24)	−2.03 (2.84)	−6.60 (8.03)

Random effects:

Variance component	Outcome			
	Head-to-toes	Decoding	Letter knowledge	Vocabulary
Residual (r)	10.59	190.83	10.76	85.78
Child (e)	3.94**	351.42**	43.25**	96.50**
Classroom (u)	.46	1.40	<.001	.17

Note. Values for fixed effects are unstandardized regression parameters. Robust standard errors are in parentheses.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

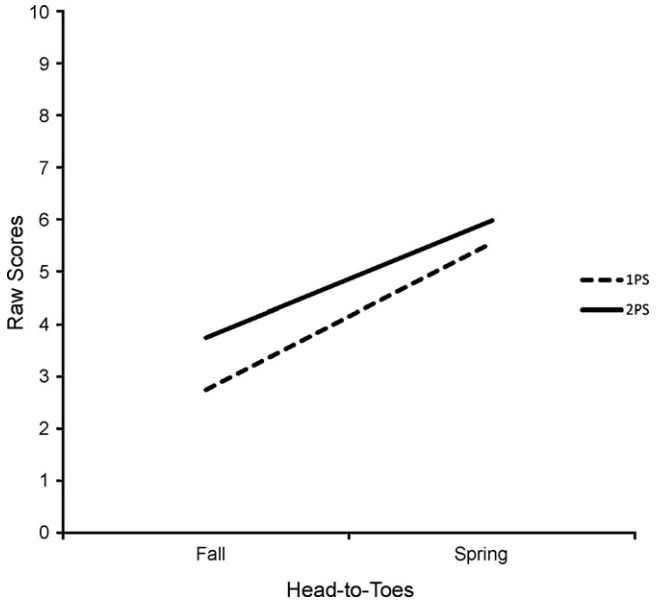

Fig. 1. Fitted mean growth in self-regulation for each group. *Note*. These two groups were not significantly different in the fall or spring of the school year.

school year. That is, both groups of children demonstrated equivalent amounts of growth (i.e., had similar slopes) during both years of preschool.

4. Discussion

Children's development of self-regulation and vocabulary (i.e., our language measure) was not associated with their experiences in either year of preschool. In contrast, children starting their second year of preschool had higher scores in the fall on measures of decoding and letter knowledge than children starting their first year of preschool. For these two measures of literacy, both groups of children grew in similar ways throughout the school year, demonstrating that the first and second year of preschool affected literacy growth similarly.

4.1. Self-regulation

Although children's self-regulation scores significantly increased from fall to spring, results indicated that this growth was attributable to general development rather than specific schooling experiences (i.e., first or second year of preschool). Although contrary to our hypothesis, this finding is consistent with the NICHD Early Child Care Research Network (2004) study which found that the child care context did not influence early social skills, including self-regulation, along with evaluations of Head Start, which did not find program effects for children's social skills (Administration for Children & Families, 2005). It is possible that children's behavioral self-regulation, as measured by the Head-to-toes task, is primarily driven by maturation.

An alternative interpretation is that self-regulation is a learned, but neglected, skill in the preschool years. Although teachers in this study, along with previous research (Rimm-Kaufman et al., 2000),

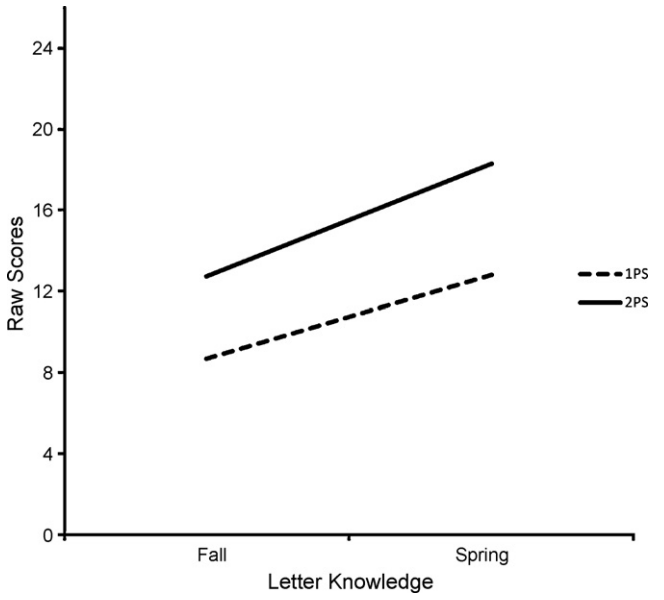

Fig. 2. Fitted mean growth in decoding for each group. *Note*. Children starting their second year of preschool began school with higher scores, although both groups of children grew similarly during the school year.

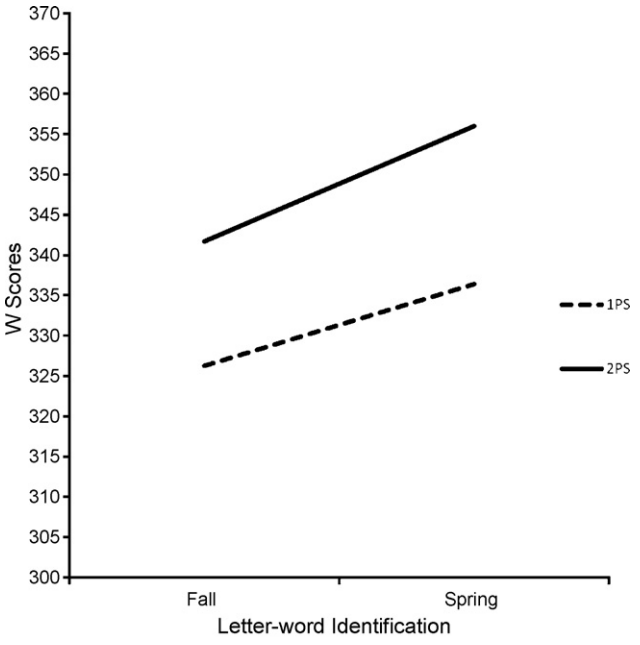

Fig. 3. Fitted mean growth in letter knowledge for each group. *Note*. Children starting their second year of preschool began school with higher scores, although both groups of children grew similarly during the school year.

indicate that early childhood educators are aware of and concerned about children's self-regulation development, they may be unsure about how to best integrate it into their daily teaching. However, preschool instruction centered around building self-regulation has shown promising gains in this area for young children (e.g., Bodrova & Leong, 2006).

Another plausible explanation, especially given the complex interplay between learning and development, is that self-regulation is a skill that is both developmental *and* learned. This suggests that at some point, children just cannot be more self-regulated than their age and maturity allow. This highlights the need to consider young children's capacity to sit still and follow directions, while simultaneously working to improve these skills in the classroom setting. Educators and policymakers should consider the behavioral demands of curricular materials before they recommend them for young children, an important consideration given the downward extension of academic curricula from the early elementary grades to the preschool years.

4.2. Literacy

Decoding and Letter Knowledge. For decoding and letter knowledge, children starting their second year of preschool had higher scores in the fall of the school year, although the skills of both groups of children grew similarly from fall to spring. Thus, our results suggest that the first and second years of preschool contribute similarly to decoding and letter knowledge gains and that these effects accumulate. Given that children continue to exhibit growth during the second year of preschool beyond what they achieved during their first year, there is reason to believe that children profit from an additional year of exposure to preschool. This coincides with previous research, which has indicated that children from low-income neighborhoods who attend a preschool program for two years start and end kindergarten with more advanced academic skills than children who only attend preschool for one year (Reynolds, 1995).

These findings are also consistent with previous research showing that classrooms that focus on early decoding skills and letter knowledge have children with more sophisticated skills (Connor et al., 2006). Although previous research suggests that preschools vary in the degree to which they focus on early literacy skills (e.g., Connor et al., 2006; Pianta, 2007), preschool teachers have been encouraged to focus on beginning literacy skills like letter knowledge as a prerequisite for kindergarten entry (Justice, Bowles, et al., 2009; Justice, McGinty, et al., 2009). Given that these early reading skills are highly predictive of later reading success (Catts & Kamhi, 2004; Catts et al., 1999; National Early Literacy Panel, 2008), it is reassuring to have preliminary findings demonstrating that schooling is associated with the development of early literacy skills in preschool, especially as a potential way to minimize the vast differences in children's skills when they begin kindergarten.

4.3. Language

Vocabulary. For vocabulary, there was growth associated with age, but not with schooling. That is, development of vocabulary was similar whether children were in either the first or second year of preschool. Much of children's vocabulary gains during preschool have been attributed to their play experiences during this time, rather than specific schooling experiences (Connor et al., 2006). For the middle- to upper-class preschoolers focused on in the present work, the schooling environment may provide similar learning experiences (e.g., dramatic play) to those children are likely to receive at home. Previous research indicates that certain home literacy experiences predict children's growth in vocabulary, including the number of books at home and parent-child book reading interactions (Hood et al., 2008; Sénéchal et al., 1996). In addition, recent evidence suggests teachers do not focus much of their time on explicit vocabulary instruction relative to other aspects of literacy development in the first years of school (e.g., Juel et al., 2003). Thus, the lack of schooling effects for vocabulary noted in the present study may reflect the age of participants and their home experiences as well as the instructional foci in the classroom.

4.4. Limitations and future directions

Our sample was located in one school district consisting of children from predominantly middle- to upper-SES families, with only 10% of students attending Head Start. Thus, it is unclear whether these results would generalize to other populations of children. Note that preschoolers' self-regulation can be assessed using many different measures (e.g., parent report, delay of gratification tasks, tasks of emotion regulation). The measure used in the current study has been used with young children successfully in the past (e.g., McClelland, Morrison, & Holmes, 2000; Ponitz et al., 2008; Ponitz, McClelland, Matthews, & Morrison, 2009); nevertheless, it is possible that different results would have been obtained had we focused on a different aspect of self-regulation or if we had included a battery of self-regulation tasks.

Given the variation in preschool participation across race/ethnicity and SES groups (Barnett & Yarosz, 2004), it is important that future work include more diverse samples in order to better understand how preschool may or may not influence children's development in specific and unique ways. In addition, the majority of teachers had bachelor's, and in some instances, master's degrees, along with multiple years of teaching experience, neither of which is necessarily the standard for preschool teachers across the country. Such high levels of education may have affected the instructional emphases in the classroom and, as a result, the schooling effects found in the present study. Extensions of the present study will include an analysis of coded videotaped classroom observations that document the specific instructional practices used by teachers in these classrooms in order to document more precisely the instruction that children received in school.

5. Conclusion

The current study suggests that typical preschool experiences are associated with gains in some, but not all, of children's school readiness skills. For literacy, those skills emphasized in preschool, such as decoding and letter knowledge, are positively affected by time spent in preschool. Results suggest effects accumulate and that more preschool is better than less, as children demonstrated significant growth during both years of school. Thus, children completing their second year of preschool had higher scores on decoding and letter knowledge than children finishing their first year of preschool, even though the two groups of children were similar in age. In contrast, vocabulary growth was not associated with time spent in school for either year of preschool.

The present work included self-regulation, which is emerging as an important indicator of school readiness in addition to children's literacy skills. Gains in self-regulation were associated with age but not with early schooling experiences. Although the reasons for these null effects remain unclear, professional development in the content and pedagogy of early self-regulation may serve to boost children's early self-regulation if it is not currently a focus within the classroom (akin to what has been demonstrated in first grade; see Cameron et al., 2005). In conclusion, preschool instructional strategies that combine explicit self-regulation, early literacy, and language instruction (Bodrova & Leong, 2003, 2006) may be a promising holistic approach to early childhood education, especially if children are given access to these curricula over multiple years.

References

Administration for Children and Families. (2005). *Head start impact study: First year findings*. Washington, DC: U.S. Department of Health and Human Services.

Alexander, K. L., Entwisle, D. R., & Olson, L. S. (2007). Lasting consequences of the summer learning gap. *American Sociological Review*, *72*, 167–180.

Barnett, W. S., & Yarosz, D. J. (2004). *Who goes to preschool and why does it matter? Preschool policy matters, 8*. New Brunswick, NJ: NIEER. Retrieved from http://nieer.org/

Barnett, W. S., Young, J. W., & Schweinhart, L. J. (1998). How preschool education influences long-term cognitive development and school success. In W. S. Barnett, & S. S. Boocock (Eds.), *Early care and education for children in poverty: Promises, programs, and long-term results* (pp. 11–44). Albany, NY: State University of New York Press.

Bisanz, J., Morrison, F. J., & Dunn, M. (1995). Effects of age and schooling on the acquisition of elementary quantitative skills. *Developmental Psychology*, *31*, 221–236. doi:10.1037/0012-1649.31.2.221

Blair, C. (2002). School readiness: Integrating cognition and emotion in a neurobiological conceptualization of children's functioning at school entry. *American Psychologist*, *57*, 111–127. doi:10.1037/0003-066X.57.2.111

Bodrova, E., & Leong, D. J. (2003). Self-regulation in the early childhood classroom. *Scholastic Early Childhood Today*, *18*, 16. doi:10.1080/1090102970180205

Bodrova, E., & Leong, D. J. (2006). Self-regulation as a key to school readiness. In M. J. Zaslow, & I. Martinez-Beck (Eds.), *Critical issues in early childhood professional development* (pp. 203–224). Baltimore: Brookes.

Boethel, M. (2004). *Readiness: School, family, and community connections*. Austin, TX: National Center for Family and Community Connections with Schools.

Bronson, M. B. (2000). *Self-regulation in early childhood: Nature and nurture*. New York: Guilford.

Bronson, M. B., Tivnan, T., & Seppanen, P. S. (1995). Relations between teacher and classroom activity variables and the classroom behaviors of prekindergarten children in Chapter 1 funded programs. *Journal of Applied Developmental Psychology*, *16*, 253–282. doi:10.1016/0193-3973(95)90035-7

Bryant, D. M., Peisner-Feinberg, E. S., & Clifford, R. M. (1993). *Evaluation of public preschool in North Carolina (ERIC No. ED373882)*. Chapel Hill: University of North Carolina.

Burchinal, M. R., Peisner-Feinberg, E., Pianta, R. C., & Howes, C. (2002). Development of academic skills from preschool through second grade: Family and classroom predictors of developmental trajectories. *Journal of School Psychology*, *40*, 415–436. doi:10.1016/S0022-4405(02)00107-3

Cahan, S., & Davis, D. (1987). A between-grade-levels approach to the investigation of the absolute effects of schooling on achievement. *American Educational Research Journal*, *24*, 1–12.

Cameron, C. E., Connor, C. M., & Morrison, F. J. (2005). Effects of variation in teacher organization on classroom functioning. *Journal of School Psychology*, *43*, 61–85. doi:10.1016/j.jsp.2004.12.002

Campbell, R., Pungello, E. P., Miller-Johnson, S., Burchinal, M. R., & Ramey, C. T. (2001). The development of cognitive and academic abilities: Growth curves from an early childhood educational experiment. *Developmental Psychology*, *27*, 231–242. doi:10.1037/0012-1649.37.2.231

Campbell, F. A., & Ramey, C. T. (1995). Cognitive and school outcomes for high-risk African-American students at middle adolescence: Positive effects of early intervention. *American Educational Research Journal*, *32*, 743–772.

Catts, H. W., Fey, M., Zhang, X., & Tomblin, B. (1999). Language basis of reading and reading disabilities: Evidence from a longitudinal investigation. *Scientific Studies of Reading*, *3*, 331–361. doi:10.1207/s1532799xssr0304_2

Catts, H. W., Fey, M. E., Zhang, X., & Tomblin, J. B. (2001). Estimating the risk of future reading difficulties in kindergarten children: A research-based model and its clinical implementation. *Language, Speech and Hearing Services in Schools*, *32*, 38–50. doi:10.1044/0161-1461(2001/004)

Catts, H., & Kamhi, A. G. (Eds.). (2004). *Language basis of reading disabilities*. Needham Heights, MA: Allyn & Bacon.

Child Trends Databank. (2006). *Preschool and prekindergarten programs*. Retrieved from http://www.childtrendsdatabank.org/indicators/103prekindergarten.cfm.

Christian, K., Morrison, F. J., Frazier, J. A., & Massetti, G. (2000). Specificity in the nature and timing of cognitive growth in kindergarten and first grade. *Journal of Cognition and Development*, *1*, 429–448. doi:10.1207/S15327647JCD0104_04

Connor, C. M., Morrison, F. J., & Slominski, L. (2006). Preschool instruction and children's emergent literacy skill growth. *Journal of Educational Psychology*, *98*, 665–689. doi:10.1037/0022-0663.98.4.665

Connor, C. M., Ponitz, C. C., Phillips, B. M., Travis, Q. M., Glasney, S., & Morrison, F. J. (in press). Individualizing student instruction and children's literacy and self-regulation in first grade classrooms. *Journal of School Psychology*.

De Feyter, J. J., & Winsler, A. (2009). The early developmental competencies and school readiness of low-income, immigrant children: Influences of generation, race/ethnicity, and national origins. *Early Childhood Research Quarterly*, *24*, 411–431. doi:10.1016/j.ecresq.2009.07.004

Dickinson, D. K., Anastasopolous, L., McCabe, A., Peisner-Feinberg, E. S., & Poe, M. D. (2003). The comprehensive language approach to early literacy: The interrelationships among vocabulary, phonological sensitivity, and print knowledge among preschool-aged children. *Journal of Educational Psychology*, *93*, 465–481. doi:10.1037/0022-0663.95.3.465

Dowsett, S. M., & Livesey, D. J. (2000). The development of inhibitory control in preschool children: Effects of "executive skills" training. *Developmental Psychobiology*, *36*, 161–174.

Duncan, G., Dowsett, A., Claessens, K., Magnuson, K., Huston, A., Klebanov, P., et al. (2007). School readiness and later achievement. *Developmental Psychology*, *43*, 1428–1446.

Geary, D. C., Bow-Thomas, C. C., Liu, F., & Siegler, R. S. (1996). Development of arithmetical competencies in Chinese and American children: Influence of age, language, and schooling. *Child Development*, *67*, 2022–2044. doi:10.2307/1131607

Gormley, W. T., Gayer, T., Phillips, D., & Dawson, B. (2005). The effects of universal pre-k on cognitive development. *Developmental Psychology*, *41*, 872–884. doi:10.1037/0012-1649.41.6.872

Hammill, D. D. (2004). What we know about correlates of reading. *Exceptional Children*, *70*, 453–468.

Hood, M., Conlon, E., & Andrews, G. (2008). Preschool home literacy practices and children's literacy development: A longitudinal analysis. *Journal of Educational Psychology*, *100*, 252–271. doi:10.1037/0022-0663.100.2.252

Howse, R. B., Lange, G., Farran, D. C., & Boyles, C. D. (2003). Motivation and self-regulation as predictors of achievement in economically disadvantaged young children. *Journal of Experimental Education*, *71*, 151–174.

Juel, C., Biancarosa, G., Coker, D., & Deffes, R. (2003). Walking with Rosie: A cautionary tale of early reading instruction. *Educational Leadership*, *60*, 12–18.

Justice, L. M., Bowles, R. P., Pence Turnbull, K. L., & Skibbe, L. E. (2009). School readiness among children with varying histories of language difficulties. *Developmental Psychology*, *45*, 460–476. doi:10.1037/a0014324

Justice, L. M., McGinty, A., Gou, Y., & Moore, D. (2009). Implementation of responsiveness to intervention in early education settings. *Seminars in Speech and Language*, *30*, 59–74. doi:10.1055/s-0029-1215715

Kagan, J. (1984). *The nature of the child*. New York: Basic Books.

Lee, V. E., & Burkam, D. (2002). *Inequality at the starting gate: Social background differences in achievement as children begin school*. Washington, DC: Economic Policy Institute.

McClelland, M. M., Acock, A. C., & Morrison, F. J. (2006). The impact of kindergarten learning-related social skills on academic trajectories at the end of elementary school. *Early Childhood Research Quarterly*, *21*, 471–490. doi:10.1016/j.ecresq.2006.09.003

McClelland, M. M., Cameron, C. E., Connor, C. M., Farris, C. L., Jewkes, A. M., & Morrison, F. J. (2007). Links between behavioral regulation and preschoolers' literacy, vocabulary, and math skills. *Developmental Psychology*, *43*, 947–959. doi:10.1037/0012-1649.43.4.947

McClelland, M. M., & Morrison, F. J. (2003). The emergence of learning-related social skills in preschool children. *Early Childhood Research Quarterly*, *18*, 206–224. doi:10.1016/S0885-2006(03)00026-7

McClelland, M. M., Morrison, F. J., & Holmes, D. L. (2000). Children at risk for early academic problems: The role of learning-related social skills. *Early Childhood Research Quarterly*, *15*, 307–329. doi:10.1016/S0885-2006(00)00069-7

McCoach, B. D., O'Connell, A. A., Reis, S. M., & Levitt, H. A. (2006). Growing readers: A hierarchical linear model of children's reading growth during the first 2

years of school. *Journal of Educational Psychology*, *98*, 14–28. doi:10.1037/0022-0663.98.1.14
McCrea, S. M., Mueller, J. H., & Parrila, R. K. (1999). Quantitative analyses of schooling effects on executive function in young children. *Child Neuropsychology*, *5*, 242–250. doi:10.1076/0929-7049 (199912)05:04;1-R;FT242
Morrison, F. J., Griffith, E. M., & Alberts, D. M. (1997). Nature-nurture in the classroom: Entrance age, school readiness, and learning in children. *Developmental Psychology*, *33*, 254–262. doi:10.1037/0012-1649.33.2.254
Morrison, F. J., Griffith, E. M., & Frazier, J. A. (1996). Schooling and the 5 to 7 shift: A natural experiment. In A. J. Sameroff, & M. M. Haith (Eds.), *The five to seven year shift: The age of reason and responsibility* (2nd ed., pp. 161–186). Chicago, IL: University of Chicago Press.
Morrison, F. J., Smith, L., & Dow-Ehrensberger, M. (1995). Education and cognitive development: A natural experiment. *Developmental Psychology*, *31*, 789–799. doi:10.1037/0012-1649.31.5.789
National Early Literacy Panel. (2008). *Developing early literacy: Report of the National Early Literacy Panel*. Washington DC: National Institute for Literacy.
NICHD Early Child Care Research and Network. (2004). Multiple pathways to early academic achievement. *Harvard Educational Review*, *74*, 1–29.
NICHD Early Child Care Research Network. (2005). Pathways to reading: The role of oral language in the transition to reading. *Developmental Psychology*, *41*, 428–442. doi:10.1037/0012-1649.41.2.428
Pianta, R. (2002). *School readiness: A focus on children, families, communities, and schools, The informed educator series*. Arlington, VA: Educational Research Service.
Pianta, R. (2007). Preschool is school, sometimes. *Education Next*, 44–49.
Ponitz, C. C., McClelland, M. M., Jewkes, A. M., Connor, C. M., Farris, C. L., & Morrison, F. J. (2008). Touch your toes! Developing a direct measure of behavioral regulation in early childhood. *Early Childhood Research Quarterly*, *23*, 141–158. doi:10.1016/j.ecresq.2007.01.004
Ponitz, C. C., McClelland, M. M., Matthews, J. S., & Morrison, F. J. (2009). Touch your knees! Using a direct observation of behavioral regulation to predict math, literacy, and vocabulary achievement in kindergarten. *Developmental Psychology*, *45*, 605–619.
Raudenbush, S. W., Bryk, A. S., & Congdon, R. (2005). *HLM 6.01: Hierarchical linear and nonlinear modeling*. Lincolnwood, IL: Scientific Software International, Inc.
Reynolds, A. J. (1995). One year of preschool intervention or two: Does it matter? *Early Childhood Research Quarterly*, *10*, 1–31. doi:10.1016/0885-2006(95)90024-1
Rimm-Kaufman, S. E., Pianta, R. C., & Cox, M. J. (2000). Teacher's judgments of problems in the transition to kindergarten. *Early Childhood Research Quarterly*, *15*, 147–166. doi:10.1016/S0885-2006(00)00049-1
Rogoff, B., & Toma, C. (1997). Shared thinking: Community and institutional variations. *Discourse Processes*, *23*, 471–497. Retrieved from http://www.tandf.co.uk/journals/titles/0163853X.asp
Rubin, D. B. (1997). Estimating causal effects from large data sets using propensity scores. *Annals of Internal Medicine*, *5*(8 Pt 2), 757–763, 127.
Sénéchal, M., LeFevre, J., Hudson, E., & Lawson, P. (1996). Knowledge of picture books as a predictor of young children's vocabulary. *Journal of Educational Psychology*, *88*, 520–536. doi:10.1037/0022-0663.88.3.520
Shonkoff, J. P., & Phillips, D. A. (Eds.). (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington, DC: National Academy Press.
Stipek, D. (2002). At what age should children enter kindergarten? A question for policy makers and parents. *SRCD Social Policy Report*, *16*(2).
Stipek, D. (2006). No Child Left Behind comes to preschool. *The Elementary School Journal*, *106*, 455–465. doi:10.1086/505440
Teale, W. H., & Sulzby, E. (Eds.). (1986). *Emergent literacy: Writing and reading*. Norwood, NJ: Ablex.
van Kleeck, A. (1998). Preliteracy domains and stages: Laying the foundations for beginning reading. *Journal of Children's Communication Development*, *20*, 33–51.
Whitehurst, G. J., & Lonigan, C. J. (1998). Child development and emergent literacy. *Child Development*, *69*, 848–872. doi:10.1111/j.1467-8624.1998.tb06247.x
Woodcock, R. W., & Mather, N. (2001). *Woodcock Johnson psycho-educational battery-III*. Itasca, IL: Riverside Publishing Company.