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

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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.

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

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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 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.

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, Acock, & Morrison, 2006; McClelland et al., 2007; McClelland & Morrison, 2003). 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.

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, Fey, Zhang, & Tomblin, 1999; Catts & Kamhi, 2004). 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).

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.

School Cut-off 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 cut-off 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 & 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; Morrison et al., 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; Morrison et al., 1995), has yet to be utilized with children prior to kindergarten.

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.

Method

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 ($X^2 = .04$, $p = .84$). 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.

Although the birthday cut-off 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.

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 ($M=12.1$ hours per week; $SD = 8.48$;

Range = 5 to 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 ($X^2(76) = 2.05, p = .15$). 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 to 23).

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 minutes. 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 and colleagues (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.

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 Equation 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).

$$\begin{aligned} Y_{itj} &= \pi_{0ij} + \pi_{1ij} * \text{time}_t + e_{0itj} \\ \pi_{0ij} &= \beta_{00j} + r_{00ij} \\ \pi_{1ij} &= \beta_{10j} \\ \beta_{00j} &= \gamma_{000} + u_{00j} \\ \beta_{10j} &= \gamma_{100} \end{aligned} \quad (1)$$

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

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.

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), 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.

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 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.

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.

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 et al., 2000; Ponitz et al., 2008, 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.

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.

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Figure 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.

Figure 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.

Figure 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.

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	<i>p</i>
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	

Table 2

Preschoolers' Fall and Spring Self-regulation, Literacy, and Language Scores

<i>Measure</i>	<i>Group</i>	<i>Fall M (SD)</i>	<i>Spring M (SD)</i>
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	0.57 (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