

SOCIAL-EMOTIONAL EFFECTS OF EARLY CHILDHOOD EDUCATION
PROGRAMS IN TULSA

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ABSTRACT

This paper assesses the effects of Tulsa, Oklahoma's early childhood education programs on social-emotional outcomes, using teacher ratings of children's disobedience, aggression, attention-seeking, apathy, and timidity from the Adjustment Scales for Preschool Intervention (ASPI) and a separate measure of attentiveness as the dependent variables and OLS fixed effects with propensity score matching as the estimating technique. The sample consists of 3,167 kindergarten students in October 2006 who had participated in either the Tulsa Public Schools (TPS) pre-K program or the CAP of Tulsa County Head Start program the previous year. Participation in both the TPS and Head Start pre-K programs was associated with lower timidity ratings, while participation in the TPS pre-K program was also associated with lower ratings on attention-seeking behavior and apathy, and higher ratings on attentiveness. We conclude that high-quality preschool programs can enhance social-emotional development, perhaps especially in domains of behavior that affect the child's attentiveness and engagement in learning.

Social-Emotional Effects of Early Childhood Education Programs in Tulsa

In recent years, several studies have concluded that state-funded pre-K programs enhance the cognitive development of children. These studies, which use a variety of methods to assess pre-K in a variety of settings, have found positive impacts on pre-reading, pre-writing, and pre-math skills in Georgia, Oklahoma, Michigan, South Carolina, New Jersey, and West Virginia (Barnett, Lamy & Jung, 2005; Henry et al., 2003; Gormley, Gayer, Phillips & Dawson, 2005; Wong, Cook, Barnett & Jung, 2008). These findings mirror evidence from research on center-based child care linking cognitive and language gains to time spent in these arrangements (Fantuzzo, et al., 2005; NICHD ECCRN, 2003, in press; Peisner-Feinberg et al., 1999) and from evaluations of early childhood interventions demonstrating short- and long-term gains in various educational outcomes (Administration for Children and Families, 2006; Campbell et al., 2002; Reynolds, Temple, Robertson & Mann, 2001; Schweinhart & Weikart, 1997; Schweinhart, et al., 2005; Zill et al., 2003).

In contrast to this increasingly rich body of studies on pre-K and cognitive development, far less is known about the effects of pre-K on social and emotional development. This is a serious gap in knowledge given rapid growth in pre-K enrollment in the U.S. and substantial evidence that young children's social-emotional development sets the stage for subsequent social-emotional functioning and plays a role in later academic achievement. Just between 2002 and 2007, the percentage of our nation's 4-year-olds who were enrolled in State-funded pre-K programs rose from 14% to 22% (Barnett, et al., 2007). For very low-income children, this trend can be traced back to the

establishment of Head Start in 1965 – a program that now enrolls over 10% of the nation’s 4-year olds.

This study examines the effects of Tulsa, Oklahoma’s early childhood education programs on social-emotional outcomes at kindergarten entry. As such, it extends our prior work demonstrating substantial positive impacts of the Tulsa pre-K and Head Start programs on cognitive development, including pre-reading skills, pre-writing skills, and pre-math skills (Gormley, Phillips, & Gayer, 2008). We focus on children who were enrolled in either the Tulsa Public Schools (TPS) pre-K program or the Community Action Project (CAP) of Tulsa County Head Start program during the year prior to kindergarten. Oklahoma’s pre-K program has received national attention because, as one of a handful of programs with universal eligibility, it reaches a higher percentage of four-year-olds (68%) than any other program in the nation (Barnett al. al., 2007). It also offers atypically high quality preschool education (Phillips, Gormley, & Lowenstein, in press), perhaps in part because Oklahoma requires a lead teacher with a B.A. degree who is early-childhood-certified in every classroom and pays these teachers regular school system wages. In Tulsa, the CAP Head Start program follows the same guidelines. As a result, this investigation may be seen as offering a “best case scenario” look at the potential contribution of high-quality school-based pre-K and Head Start programs to children’s social-emotional development.

Social-emotional Development

Young children’s social-emotional development captures a broad swath of specific outcomes, ranging from the ability to identify and understand one’s own and others’ feelings, establish and sustain relationships with both peers and adults, and

regulate one's behavior, emotions, and thoughts (National Scientific Council on the Developing Child, 2005). The importance of these foundational capacities has been well-documented. Having behavior problems in early childhood, for example, is associated with low peer acceptance, maladaptive teacher-child relationships, and anti-social disorders and delinquency in middle childhood and adolescence (Brody et al., 2003; Ladd & Burgess, 1999; Nagin & Tremblay, 2001; Shaw, Owens, Giovannelli, & Winslow, 2001; White, Moffitt, Earls, Robins, & Silva, 1990). Early childhood behavior that is more internalizing in nature, such as fearfulness or behavioral inhibition, is also associated with the development of serious anxiety problems in middle childhood and beyond (Tincas, Benga & Fox, 2006; Fox et al., 2005; Schwartz, Wright, Shin, Kagan, & Rauch, 2003).

The emergence of emotional and behavioral problems in children is much more likely under conditions of adversity, with poverty and low social-economic status having been studied extensively in this context. Deep and prolonged poverty, perhaps especially during the early childhood years (Duncan, Yeung, Brooks-Gunn, & Smith, 1998), has been found repeatedly to predict emotional and behavioral problems in children, even after accounting for parent and family characteristics (Bradley & Corwyn, 2002; Dodge, Pettit, & Bates, 1994; Duncan, Brooks-Gunn, & Klebanov, 1994; McLoyd, 1998; Ripke & Huston, 2005). The effects of poverty appear to be more pronounced for externalizing behavior problems (e.g., aggression, defiance) than for internalizing behavior problems (e.g., social withdrawal, depression) (Bradley & Corwyn, 2002; Brooks-Gunn & Duncan, 1997).

In a classroom context, kindergarten teachers rank social-emotional skills such as self-control and sustained attention as more critical for school readiness than content knowledge (Rimm-Kaufman, Planta, & Cox, 2000). Empirical work, however, has generated mixed evidence regarding links between early social-emotional adjustment and academic achievement (see, for example, Jimerson, Egeland, & Teo, 1999; McClelland, et al., 2007; and Miles & Stipek, 2006). In a meta-analysis of six longitudinal studies, Duncan et al., (2007) found that attention-related skills were the only aspect of social-emotional development at school entry that related to later academic outcomes. This is consistent with a growing body of research that suggests that children's capacities to sustain attention and to regulate emotions and behavior contribute to school success by supporting effective approaches to learning (Barnett et al., 2008; Bierman, et al., in press; Blair, 2002; Diamond, Barnett, Thomas, & Munro, 2007; Fantuzzo, et al., 2007; Ladd & Profilet, 1996).

Research in Head Start programs with the same instrument that we used in Tulsa (the Adjustment Scales for Preschool Intervention [ASPI], Lutz, Fantuzzo & McDermott, 2002a,b) has demonstrated that behavior at the end of the program year is most strongly predicted by children's withdrawn and socially reticent behavior at the beginning of the year (Fantuzzo et al., 2003). The end of year outcomes included problems connecting with and establishing positive peer relationships, but also receptive and expressive vocabulary skills and disengagement from learning. Similarly, Bulotsky-Shearer and colleagues (Bulotsky-Shearer, Fantuzzo, & McDermott, 2008), using the same instrument, found that both social reticence and withdrawn behavior predicted the extent to which children stayed engaged in learning tasks. Recent extensions of this work have

found that children who displayed regulated behavior (positive social interactions and attention control with low aggressive behavior) and academically engaged behavior (high competence motivation and low withdrawn behavior) at the beginning of the Head Start year, scored higher on tests of early reading and language skills in first grade (Bulotsky-Shearer, Fantuzzo, Dominguez, & McDermott, 2009). Other strands of evidence have documented the contribution of early behavior problems and externalizing behavior to school achievement in the years immediately following school entry (Bub, McCartney & Willett, 2007).

The Contribution of Early Childhood Programs

In light of teachers' concerns about social-emotional development and emerging evidence that both academic and social-emotional aspects of school performance may be affected by children's early social-emotional competencies, those who study early childhood programs have increasingly turned their attention to this domain of behavior. There is, in fact, a long-standing child care literature in this area growing out of concerns that early non-maternal care would undermine parents' role in fostering compliance and prosocial behavior (NICHD ECCRN, 1998). On the one hand, evidence has documented that children who spend more time in non-parental child care – especially center-based care -- during the early childhood years display higher levels of externalizing and aggressive behavior, as well as more adult-child conflict, at 54 months and at kindergarten age, and behavior problems through sixth grade (Belsky et al., 2007; Loeb, Bridges, Bassok, Fuller & Rumberger, 2007; NICHD Early Child Care Research Network [ECCRN], 2003, 2005; Vandell & Corasaniti, 1990). There is also counter-evidence that children cared for in centers display more prosocial behavior, competence

with strangers and independence from their mothers in play settings (Vandell, 2004; Votruba-Drzal, Coley & Chase-Lansdale, 2004). Moreover, exposure to group child care during the early childhood years appears to contribute to reduced levels of internalizing and inhibited behavior, perhaps especially if the quality of care is high and for children who are at risk of highly inhibited behavior (Crockenberg & Leerkes, 2005; Fox, Henderson, Rubin, Calkins, & Schmidt, 2001). Finally, there is some evidence that exposure to center-based care does not have the same negative impacts on low-income and other high-risk children (Loeb, Fuller, Kagan, & Carrol, 2004; Lowenstein & Phillips, submitted; Votruba-Drzal et al., 2004). When quality is high, spending more hours in non-maternal care has been associated with decreases in low-income children's behavior problems (Votruba-Drzal et al., 2004).

Research specifically on Early Head Start and Head Start, which serve predominantly very low-income children, has revealed both positive and negative impacts on social-emotional behavior. Negative effects on self-control, interpersonal skills, and increases in externalizing behavior have been found in secondary analyses of large, national datasets that rely on parental reports of where their preschoolers received care (Loeb et al., 2007; Magnuson et al., 2007). In contrast, positive impacts have been reported from recent randomized trials of Head Start and Early Head Start (EHS) and, in terms of long-term impacts on criminal behavior, from sibling comparison studies (Garces, Thomas, & Currie, 2002). Specifically, first-year findings from the Head Start Impact Study show that participation in Head Start was associated with reductions in parent-reported total problem behaviors among 3-year-olds (but not ratings specifically of aggression or withdrawn behavior) and parent-reported aggressive behavior among 4-

year-olds. No effects were found for parent-reported social skills or positive approaches to learning (U.S. Department of Health and Human Services, 2005). Findings from an age-5 follow-up to the EHS randomized trial further indicate that children who participated in center-based child care, Head Start, or pre-K after age 3 showed increased levels of parent-reported aggressive behavior unless they had also attended EHS as infants and toddlers, in which case they displayed significantly lower levels of aggression compared to those who did not attend EHS (Administration for Children and Families, 2006).

Others have turned to large, national datasets – notably the Early Childhood Longitudinal Study-Kindergarten cohort (ECLS-K) -- to examine the social-emotional consequences of exposure to early childhood programs using OLS regression, instrumental variable, and propensity score techniques. Collapsing children who were reported by parents to be in a day care center, preschool, or pre-K program into a broad “center care” category, Loeb and colleagues (Loeb, Bridges, Bassock, Fuller & Rumberger, 2007) found a positive association between center enrollment and behavior problems. Negative behavioral effects were greater for children who started center care at an earlier age and were greater for whites than for blacks, and were non-significant for Hispanics (Loeb et al. 2007). Magnuson, Ruhm, & Waldfogel (2007) also found a positive association between pre-K participation, as defined by parents, and externalizing behavior. In addition, they found a negative relationship between pre-K participation and self-control, although this relationship disappeared when they switched from OLS regression to other estimating techniques. Magnuson et al (2007) found similar effects when they limited their analyses to children from disadvantaged families. Interestingly,

they found that social-emotional effects became non-significant if a child's pre-K program and kindergarten class were situated in the same school. It is important to note that because parents' retrospective reports on their children's early childhood program types are of unknown reliability (Lopez & Barrueco, 2005), firm conclusions from these studies about subsets of programs within the spectrum of early childhood options should be approached with caution.

Pre-Kindergarten Programs and Social-Emotional Development

Beyond the work of Magnuson and colleagues (2007) on pre-kindergarten programs, there is a dearth of research on social-emotional impacts specific to school-based pre-K experience. Reynolds (1989), who analyzed data from 1,539 ethnic minority children, some of whom had enrolled in Chicago Parent Child Center (PCC) preschools administered by the Chicago public schools since 1967, found that preschool participation had no direct effects on social-emotional maturity at first grade but that it did have positive indirect effects, mediated through higher levels of parent involvement. Graduates from this program also had higher rates of high school completion and lower rates of official juvenile arrests (Reynolds, Temple Robertson, & Mann, 2001). Gormley and Gayer (2005), who analyzed data from 2,273 children who participated in or were about to participate in Tulsa's pre-K program, found no effects of pre-K participation on social-emotional development. However, they cautioned that their assessment was seriously flawed because it was based on teachers' first impressions of new students captured with a "home-grown" 4-item instrument.

In a recent study of pre-K in 11 states, based on a predominantly low-income sample of children, Howes and colleagues (2008) found that pre-K attendance was

associated with a small increase in children's social skills between the fall and spring of the pre-K year, and a small decrease in behavior problems among children of mothers with low levels of education. Larger gains in social skills were associated with teacher reports of warmer relationships with the child. The importance of the teacher-student relationship and of the emotional climate in the classroom as they relate to the development of social competence and the prevention of problem behaviors in preschoolers was also reported by Mashburn et al. (2008).

The implications of this extensive, but balkanized literature on the social-emotional impacts of early childhood programs for newly emerging school-based pre-K programs for 4-year olds are difficult to discern. The negative effects found in the child care literature, which is non-experimental, are attributable to extensive hours in group care of highly variable quality. To the extent that quality of care plays a role, its effects are positive, perhaps especially for children from higher-risk home environments. The experimental research on Head Start appears to support this conclusion, as does the quasi-experimental work on the Chicago Parent Child Centers. The work specifically on school-based preschool programs is in its infancy, but does suggest that when preschools are connected to elementary schools, negative effects are avoided, and when the classrooms are characterized by emotionally supportive teacher-child interactions, benefits accrue to social-emotional development. The Tulsa pre-K program is both school-based and offers emotionally supportive educational environments (Phillips, Gormley & Lowenstein, in press). Examining its impacts on children's social-emotional development at the beginning of the kindergarten year is the purpose of this study.

Research Questions

The current study addresses three questions: (1) What are the effects of school-based and Head Start-based preschool programs on social-emotional behavior at kindergarten entry? (2) Do these effects persist if we focus on poor children in particular? and (3) Do program impacts depend on the classroom micro-context (interactions with adults or peers, or during learning tasks) in which social-emotional behavior manifests itself? We address these questions in the context of the relatively high-quality Tulsa pre-K program, using propensity score methodology and then teacher fixed effects to minimize selection bias in our comparisons between children who attended and did not attend these programs.

We hypothesize, based on the relative high-quality of the Tulsa pre-K program and its strong links to elementary schools, that it will generate positive effects for children's social-emotional development. Moreover, the programs' strong emphasis on academic instruction could help to prepare children for the educational challenges of kindergarten and thus reduce timidity, apathy, and acting out behaviors, although it is also plausible that excessive attention to academic instruction – or developmentally inappropriate practices – could generate or aggravate social-emotional distress.

We further hypothesize, based on the child care and Head Start literatures, that stronger links between Tulsa pre-K experience and social-emotional development will be found for low-income children. In this context, we do not anticipate differing outcomes for the TPS and Head Start programs. They follow the same quality guidelines, both offer emotionally supportive classroom environments, and, while the TPS classrooms place a greater emphasis on academic instruction (which may facilitate children's adjustment to the social challenges of schooling or may generate distress, as noted above), the Tulsa

Head Start program, like Head Start programs elsewhere, is explicitly committed to social-emotional development as one of several program goals, whereas the TPS pre-K program is not. As such, it is not obvious that one program or the other is better equipped to foster social-emotional development.

Finally, because evidence regarding social-emotional impacts of pre-K education has not taken classroom micro-contexts into consideration, hypotheses regarding different impacts for teacher, peer, and task-oriented interactions are not warranted.

Methods

Sample

A total of 186 TPS kindergarten teachers provided ratings of the social-emotional development of the children in their classrooms in October 2006. We received completed forms for 77% of the kindergarten students. As a result, the total sample consists of 3,167 kindergarteners: 1,338 TPS alumni, 366 Head Start alumni and 1,463 children who attended neither program (referred to as controls). Based on parent reports that included a large number of non-responses (and, as such, do not offer systematic data on the experience of the control children), we know that some children in the control group were in another school district's pre-K program or another CAP agency's Head Start program prior to entering kindergarten in Tulsa; some attended a day care center or family day care home; others remained at home. Our final analytic sample declined slightly when we eliminated a few children who were too old for their cohort and, more substantially, when we utilized propensity score matching, as discussed below.

As Table 1 indicates, the assessed sample of children closely resembles the universe of children in most respects (there are some minor differences in free-lunch

eligibility). Table 2, discussed below, provides descriptive information on the TPS and Head Start alumni, as well as the control children for both of these groups. Given that we conduct analyses not only on the total sample, but also on the children with free-lunch eligibility, it is important to note that 65% of the TPS alumni and 89% of the Head Start alumni fell into this subgroup.

Measures

To analyze the effects on social-emotional development of the preschool programs in Tulsa run by the public schools and by Head Start, we chose the Adjustment Scales for Preschool Intervention (ASPI) instrument developed by researchers at the University of Pennsylvania (Lutz, Fantuzzo, & McDermott, 2002b). The ASPI instrument consists of 144 statements describing behaviors that children may display. The assessor checks any descriptor that applies to the child being assessed. For example, with regard to the question, “Does this child pay attention in the classroom?”, the assessor checks or does not check each of the following specific behavioral descriptors: Generally listens well; Talks, gazes around, plays with things; Sits so quietly you don’t know if he/she is attending or not; Lacks interest, ‘Just sits’; Appears to live in a dream world. As these examples make clear, the descriptors capture both good behaviors and problem behaviors, although the majority of the items do focus on problem behaviors. In addition, the rated behaviors are organized into subsets defined by classroom context (or “sitotypes”): interactions with the teachers, interactions with peers, and task-related behavior. With regard to the child’s relationship with the teacher, items assess, for example, how the child greets the teacher, seeks his or her help, and answers teacher questions. For peer relations, items assess, for example, how well the child gets along

with others his/her age and how s/he handles peer conflicts. For task-related behavior, the items inquire about, for example, how well the child pays attention, copes with new learning tasks, and his/her extent of involvement in classroom activities. As a result, the ASPI ratings can be examined in two ways: first, as phenotypes of children across classroom contexts; and second, as behaviors within specific classroom micro-contexts or situations.

ASPI was developed in close consultation with Head Start teachers, in an effort to ensure that it would be user-friendly. Teaching ratings on the ASPI at the beginning of the Head Start year have been reported to differentiate children who display socially disruptive behavior at the end of the school year and to be associated with early math ability and general classroom competencies (Fantuzzo et al., 2007). For additional information on the construct validity of the ASPI see Lutz et al. (2002a,b) and Fantuzzo, Bulotsky, McDermott, Mosca, & Lutz (2003).

As a supplement to the ASPI, we also asked teachers to assess each child's attentiveness by completing a four-item Likert scale. The four items, which together constitute a self-regulation subscale, were extracted from an 18-item-instrument known as the Instrumental Competence Scale for Young Children (Adler & Lange, 1997).

Factor Analysis

To assess the internal structure of our ASPI social-emotional assessments, we utilized common factor analysis (Snook & Gorsuch, 1989), based on all kindergarten children. We generated five factors, using orthogonal equamax rotation for the loadings: Disobedient (misbehaves and fails to follow rules), Aggressive (provokes other children, throws objects, fights), Attention-Seeking (attempts to gain teacher's attention and

impulsive), Apathetic (lacks energy and displays low classroom engagement), and Timid (shy towards teacher and displays low levels of participation). Factor scores were then calculated using OLS regression. Every response variable contributed to every factor, using precision weighting. The five factors were then standardized to have a mean of 50 and a standard deviation of 10.

For each of the five factors, the problematic behaviors received positive loadings and the positive behaviors received negative loadings. This may be because a disproportionate share of ASPI items focus on negative behaviors. Both problematic and positive behaviors received very high loadings. Given the direction of the loadings, we used “negative” behavioral labels for the factors. It is important to note that the children – those who attended pre-K or Head Start and those who did not – received proportionately many more affirmative ratings (checks) from their kindergarten teachers for positive behavior than for problematic behavior. The vast majority of the children were obedient rather than disobedient, and engaged rather than apathetic, for example. Thus, if preschool enrollment contributed to lower apathy ratings, for example, it would be most appropriate to interpret this as preventing apathy or enhancing engagement.

In addition to these five factors from the ASPI that seek to capture social-emotional dispositions (phenotypes), we identified three factors that seek to capture the classroom contexts in which social-emotional dispositions are manifested (situtypes). Although we used our own factor analysis strategy to identify such situtypes, the three factors we identified (inappropriate task-related behavior, inappropriate interactions with the teacher, inappropriate interactions with peers) precisely parallel the three identified by the University of Pennsylvania researchers who conceived of this interesting strategy

(Bulotsky-Shearer, Fantuzzo & McDermott, 2008). As with the phenotypes, the situtypes capture what might be viewed as negative or dysfunctional behaviors in specific micro-contexts (e.g., teacher vs. peer interactions and academic vs. interpersonal situations). Again, the factor analysis yielded exclusively “negative” situtypes, perhaps because the vast majority of ASPI items focused on problematic behaviors.

Procedure

After receiving permission from the Tulsa Public Schools administration and CAP of Tulsa County Head Start, we distributed the ASPI forms (and the supplementary attentiveness questions) to all kindergarten teachers. We asked the teachers to complete the forms for each child in her/his classroom during the week of October 2, 2006, approximately 40 days after the commencement of classes. We deliberately selected a time period that was early enough in the school year to approximate a pre-test but late enough to ensure that the teacher knew each child well enough to fill out the form.

In addition to the social-emotional assessment data, we obtained demographic data for each child from TPS and Head Start administrative data and from a parent survey administered in August 2006, when the same children took a cognitive development test, as arranged by us. Administrative data yielded valuable information on the child’s date of birth, gender, and race/ethnicity, as well as enrollment in the TPS pre-K or CAP Head Start program. The parent survey yielded additional information on the mother’s education, the child’s place of birth, the parent’s place of birth, the primary language spoken at home, internet access at home, whether the child’s biological father lives at home, and other variables.

Analytic Approach

We use propensity score matching and a teacher fixed effects model to assess the impact of the TPS pre-K program and the Tulsa Head Start program on social-emotional development – both phenotypes and situtypes -- for both the total sample of children and the subset who were eligible for free-lunch. Propensity score matching has been widely used by scholars assessing a variety of questions, including the effects of a job training program (Dehejia & Wahba, 1999), the effects of neighborhood poverty on dropping out of school and teenage pregnancy (Harding, 2003), and the effects of substance abuse programs (Guo, Barth, & Gibbons, 2006). As noted above, it has also been used to assess the developmental effects of pre-K (Magnuson et al., 2007).

The motivation for propensity score matching is to identify a control group that resembles the treatment group as much as possible on observable characteristics, in order to minimize selection bias. Members of the treatment and control groups are matched based on having a similar likelihood of being in the treatment group, a measure known as the propensity score, which is estimated from a wide variety of observable characteristics. That is, treated individuals are compared to individuals who “look” like members of the treatment group, but who did not actually choose the treatment.

Before settling on propensity score matching and with teacher fixed effects to estimate program effects, we actively considered an alternative – a regression discontinuity design we have used to estimate the effects of TPS pre-K on cognitive development (Gormley, Gayer, Phillips, & Dawson, 2005). Whereas propensity score matching, for our data, involves comparisons *within* a cohort (kindergarten), a regression discontinuity approach involves comparisons *across* cohorts (kindergarten, pre-K).

Comparisons across cohorts, in this study, are more problematic for social-emotional assessments than for cognitive development tests for several reasons.

First, we found that the factor structures produced by factor analysis to assess social-emotional development differ across the cohorts. Kindergarten teachers may expect a higher level of maturity than pre-K teachers, which could make for unfair comparisons across cohorts. Second, with a regression discontinuity design, we would be comparing children exposed to nine months of pre-K and 40 days of kindergarten to children exposed to no pre-K and 40 days of pre-K. A fairer comparison, if one seeks to isolate the effects of pre-K, is to compare students who differ only in their exposure to pre-K, as opposed to students who also differ in their exposure to kindergarten.

For these reasons, we use a propensity score matching approach, with kindergarten students only, rather than a regression discontinuity design, with kindergarten and pre-K students (or kindergarten and Head Start students). Although propensity score matching has its drawbacks (Wilde & Hollister 2007), it seems to be more appropriate when the comparison group is local and when short-term effects are being assessed (Bloom, Michalopoulos, Hill, & Lei, 2002). Both of these conditions apply to our Tulsa data. The use of OLS with fixed effects further strengthens our propensity score matching methodology.

To set up the propensity score matching for the TPS pre-K program participants, we used a wide variety of covariates to estimate a logit regression of the likelihood that TPS kindergarten students attended the TPS pre-K program the previous year. The covariates included gender, age, race/ethnicity, eligibility for a free or reduced price lunch, mother's education, internet access, the number of books at home, the primary

language spoke by the child at home, whether the child participated in an early childhood program as a three-year-old, whether the child lives with his/her biological father, foreign-born parents, the mother's marital status, and a variety of interaction terms. The estimated logit equation was then used to predict each individual's propensity score, namely his/her probability of having attended pre-K. Next, we used Stata's PSMATCH2 command to match treatment and control individuals based on their propensity score values (Leuven & Sianesi, 2003). A number of possible matching algorithms exist. We employed one-to-one nearest neighbor matching with replacement within a caliper of .001 to achieve the best match. We followed the same procedures for kindergarten students who attended the CAP of Tulsa County Head Start program the previous year, except with a .005 caliper. We used a slightly different caliper for the two populations because it was more difficult to find suitable matches for the Head Start population and we wanted to avoid dropping a substantial portion of our treatment group. Matching was done within program auspice.

Nearest neighbor one-to-one matching first randomly orders the treatment and control observations, then pairs the first treatment observation with the control observation with the closest propensity score, and then continues the matching process with the next treatment observation. Control observations that do not match with a treatment observation are excluded from the subsequent analysis. Matching with replacement allows a given individual in the comparison group to be used more than once if he/she is a better match for individuals in the treatment group than anyone else in the comparison group. By imposing a caliper, the matched pair must have propensity scores within .001 of each other. A caliper will improve the quality of the match, but the

tradeoff is that treated individuals for whom a good match cannot be found are dropped from the analysis. In our TPS pre-K analysis, imposing the caliper (.001) causes us to drop 181 treatment group members (out of 1,314 age-appropriate children) in order to achieve a quality match. A total of 582 “untreated” observations were used (sometimes more than once as members of the comparison group). In our Head Start analysis, imposing the caliper (.005) causes us to drop 64 treatment group members (out of 363 age-appropriate children) in order to achieve a quality match.. A total of 184 “untreated” observations were used (sometimes more than once as members of the comparison group).

Judging from a comparison of children retained and dropped from the treatment group, we can say that some children were harder to match than others. For TPS pre-K alumni, children who were black or Native American, whose mother was relatively well-educated, who lived with their biological father, and who had access to the Internet were more likely to be dropped from the treatment group because of poor matching. For Head Start alumni, children who were Asian, whose mother was relatively well-educated, who lived with their biological father, and who had access to the Internet were more likely to be dropped from the treatment group because of poor matching.

If the propensity score matching process works well, then members of the treatment group and the matched comparison group should have similar observable characteristics. As Table 2 indicates, there are only two statistically significant differences in the key demographic characteristics of our TPS pre-K alumni and our matched comparison group: the percentage Hispanic and the percentage with internet access. With these two exceptions, the matched comparison groups are extremely similar on the key demographic characteristics. There is only one statistically significant

difference in observable characteristics for Head Start alumni and our matched comparison group: the percentage of mothers who took some college courses (but did not graduate from college). Without propensity score matching, many of our key demographic variables would have been imbalanced, especially for Head Start.

Through propensity score matching, we designed very similar – but not identical – treatment and control groups. To err on the side of caution, we utilized teacher fixed effects models on the samples produced by our propensity score matching instead of simply reporting mean differences between our matched treatment and control groups. Our regression models controlled for the following child-level covariates: gender, race, free lunch eligibility, mother’s education, whether the child lives with the biological father, and internet access at home. We also included dummy variables for the child’s kindergarten teacher, to control for the possibility that teachers differed in their application of the ASPI instrument and TPS and Head Start alumni are not randomly sorted into kindergarten classrooms. The inclusion of teacher dummies has the additional advantage of enabling us to control for clustering by school in addition to classroom, since each of our teachers taught at only one school. For CAP Head Start alumni, we followed a similar strategy. Thus we produced two separate regression equations for TPS pre-K alumni and for CAP Head Start alumni, after conducting two separate propensity score matching exercises for these two treatment groups.

Of course, the two treatment groups differ in their demographic characteristics. Most notably, Head Start alumni are poorer than TPS pre-K alumni, which could help to account for any differences in program impact. For this reason, we also conducted separate propensity score matching and regression estimates for free-lunch eligible

children only which should make the TPS and Head Start samples more similar – albeit imperfectly – with regard to family income. These results are reported below, after our primary results.

Results

We first present results for the social-emotional outcomes (phenotypes) for all children, followed by results for the subsample of low-income children. Results for the classroom context analyses (situtypes) are then presented, followed by tests for program (TPS vs. Head Start) differences in impacts.

Social-Emotional Outcomes

As Table 3 indicates, children who participated in the TPS pre-K program were less timid ($p < .01$), less apathetic ($p < .05$), and marginally less prone to attention-seeking behavior ($p < .10$) than control group children who attended neither the TPS pre-K program nor Head Start. Pre-K and control group children did not differ in two other areas: disobedience and aggressiveness. On the four-item attentiveness scale, children who participated in the TPS pre-K program were more attentive ($p < .01$). Overall, children who participated in the TPS pre-K program demonstrated greater social-emotional maturity than those who entered kindergarten without the pre-K or Head Start experience. However, the effects are quite modest, with effect sizes ranging from .11 for attention-seeking behavior to .19 on the attentiveness index (see Table 3). Children who participated in the CAP of Tulsa County Head Start program were rated by their kindergarten teachers as less timid ($p < .01$, effect size = .22) than their peers who had not attended Head Start or pre-K. There were no other statistically significant findings for

Head Start, although the direction of effects for apathy, attention-seeking, and attentiveness was the same as for the TPS sample.

Because the TPS pre-K program and the CAP of Tulsa County Head Start program serve rather different children (e.g., the Head Start children are poorer and more likely to be black), we reran the analyses on samples restricted to low-income children as proxied by free lunch status. For low-income TPS pre-K alumni, we continue to see a reduction in timidity ($p < .05$) and an improvement in attention ($p < .01$) (see Table 4). For Head Start alumni, we no longer see any statistically significant results. It should be noted that we are dealing with somewhat smaller samples here and that statistical significance is, therefore, more difficult to establish. As was the case with the full sample, the direction of effects for the Head Start sample matched that for the TPS sample.

Situtype Findings

As noted earlier, we also analyzed the same data by focusing on the classroom micro-contexts in which the children's behaviors were manifested (situtypes). TPS pre-K participation was associated with a statistically significant reduction in inappropriate behavior towards the teacher ($p < .05$), as well as a marginal reduction in inappropriate behavior while working on learning tasks ($p < .10$) (see Table 5). Head Start participation was also associated with a reduction in inappropriate behavior towards the teacher, although this effect was in the marginal range ($p < .10$). Neither of the other two relationships (behavior with peers and behavior during learning tasks) was statistically significant at an acceptable level. When the sample of children was restricted to those of low income (free-lunch status), the TPS results were unchanged, but the marginally

significant Head Start result (for behavior towards the teacher) was reduced to non-significance (see Table 6).

Comparison of Program Effects

Although we have deliberately analyzed the TPS pre-K and CAP Head Start samples separately, we are interested in knowing whether the programs differ, in statistically significant terms, in their social-emotional impacts. To determine whether program impacts estimated using separate models are different, we calculated *z*-scores following a method recommended by Paternoster et al. (1998). We found no statistically significant differences between the effects of TPS pre-K and CAP Head Start, for the full sample or for low-income students. This may be due, in part, to the relatively small sample size of the Head Start alumni and the relatively high standard errors for the Head Start program's impact on social-emotional outcomes.

Discussion

The current study examined the social-emotional development of kindergarten children with differential pre-K experiences. It contributes to both the growing evaluation literature on state pre-K programs and to longstanding empirical work examining development in context. The study expanded prior research by (a) adding social-emotional developmental outcomes to the repertoire of evidence emerging from research on pre-K programs and, specifically, to evaluations of the Tulsa pre-K program, (b) examining both school-based and Head Start programs, including a subsample analysis focused on low-income children, and (c) examining social-emotional behavior in the context of specific classroom micro-contexts, as well as more generally across contexts.

The current findings indicate that high-quality, school-based pre-K programs can support the development of both cognitive and social-emotional skills that enable children to enter kindergarten ready to learn. The Head Start results were less extensive, perhaps because of smaller sample sizes. In response to the concern that children's social-emotional skills may be slighted at the expense of their cognitive skills when they attend school-based pre-K programs, our findings clearly demonstrate that such trade-offs need not occur. Not only did children in the TPS and Head Start pre-K programs fail to demonstrate the increases in aggressive and disobedient behavior seen in the child care research literature; they were portrayed by their kindergarten teachers as exhibiting lower levels of timidity than their peers who did not experience these programs as 4-year olds. The children who experienced TPS pre-K were also reported by their kindergarten teachers to be less apathetic, more attentive, and marginally less prone to attention-seeking behavior.

Because the distribution of scores on these outcomes placed the majority of children within the outgoing (rather than timid), engaged (rather than apathetic), and attentive (rather than inattentive) range of teacher ratings, it is most appropriate to interpret these findings as demonstrating that pre-K experience prevented negative social-emotional outcomes and fostered positive outcomes. For example, if we focus on apathy, 5.6% of TPS pre-K alumni appear to "lack interest" in the classroom, as opposed to 8.1% of our matched control group. To cite another example, 84.7% of TPS pre-K alumni appear to "get along with two or more companions," as opposed to 79.5% of our matched control group. Similar results are apparent for timidity (see Appendix A). In effect, children who experienced pre-K have been socialized into the engaged, attentive,

interactive role of kindergarten student to a greater extent than have children who did not experience these programs. The magnitude of statistically significant effect sizes ranged from .11 to .22 -- smaller than those reported for cognitive outcomes, but comparable to those found in other efforts to assess social-emotional impacts of early childhood programs, (see, for example, Howes et al., 2008; Loeb et al., 2007; Magnuson et al., 2007).

The study also examined patterns of association between pre-K experience and social-emotional development for the subsample of low-income children. Contrary to our hypotheses, these children not only failed to exhibit stronger impacts of pre-K attendance, they actually showed fewer significant results. The low-income children who had attended TPS pre-K programs continued to show reduced timidity and improved attentiveness, but those who had attended Head Start did not differ significantly from other low-income children who had not experienced TPS pre-K or CAP Head Start. Although the findings for these children were less impressive, this may be a function of the notably smaller sample sizes involved in these subgroup analyses.

These findings are consistent with prior evidence of positive social-emotional effects of high-quality center-based child care, Head Start and Early Head Start, the Chicago Parent Child Centers, and pre-K programs characterized by supportive teacher-child interactions and emotional climates (Howes, et al., 2008; Mashburn, et al., 2008; Reynolds et al., 2001; US DHHS, 2005), and run counter to prior evidence of detrimental social-emotional impacts of exposure to group care arrangements across the early childhood years (Belsky et al., 2007; Loeb et al., 2007; NICHD ECCRN, 2003, 2005). It may be that the relatively high quality of emotional support in the Tulsa pre-K and Head

Start classrooms (Phillips, Gormley, & Lowenstein, in press) is partially responsible for this absence of “bad news”. Further, the Tulsa pre-K programs are connected to elementary schools, which prior work suggests may play a role in avoiding negative effects of early exposure to preschool (Magnuson et al., 2007). It is also the case that the Tulsa pre-K programs place a relatively strong emphasis on academic instruction, which may not only promote pre-academic skills but also foster self-confidence in school-like settings which, in turn, would be expected to reduce timidity, apathy, and attention-seeking behaviors in kindergarten. The Tulsa Head Start programs, guided by National Performance Standards, are also explicitly committed to fostering social-emotional competence, although the relatively fewer significant social-emotional impacts found for the Head Start alumni (as compared to the TPS alumni) suggests that this commitment, per se, does not necessarily produce enduring social-emotional benefits. It may also be the case, of course, that remaining selection effects not controlled by our methods led parents of more poorly behaved children to enroll in the Tulsa pre-K programs at lower rates.

Our third objective was to examine whether the effects of pre-K experience were more apparent in certain classroom micro-contexts than in others. Children who attended either TPS pre-K or Head Start were reported by their teachers as showing significantly more appropriate behavior towards the teacher than children who attended neither program, and the TPS alumni were also reported to display marginally more appropriate behavior during learning tasks. The findings for the TPS alumni were sustained when the sample was restricted to low-income children; the Head Start findings were reduced to non-significance.

While we did not formulate specific hypotheses regarding classroom context effects, it appears that pre-K experience has its strongest impacts in the context of teacher-child interactions. The importance of this finding is underscored by prior evidence that warmer teacher-child interactions and the observed quality of emotional interactions between teachers and children are among the strongest predictors of increases in children's social skills and decreases in problem behaviors during the pre-K year (Howes et al., 2008; Mashburn et al., 2008). The current findings suggest that the children's experiences of positive teacher-student relationships in pre-K may carry over to the kindergarten year as a result of either enhanced social skills or higher expectations of teacher support. Indeed, the positive teacher reports of their interactions with the pre-K alumni may underlie their positive ratings of the children's social-emotional behavior, although, given the non-independence of these ratings, we cannot suggest a predictive role in this study. An important direction for future research would be to examine whether pathways from pre-K experience to constructive behavior in kindergarten are mediated through the quality of teacher-child relationships across this important school transition.

These findings highlight the importance of expanding the typical range of social-emotional behaviors that are examined in research on early childhood programs. The early childhood field has paid much greater attention to externalizing behavior and, specifically, to aggression and other behavior problems, than it has to either internalizing behavior, such as timidity, or regulatory behavior, such as attentiveness. And yet, emerging intervention and empirical research that seeks to understand which social-emotional competencies cross over to affect school performance is increasingly

converging on regulatory behavior, including executive functioning and attentional capacities (Blair, 2002; Diamond et al., 2007; Duncan et al., 2007), and other aspects of behavior that promote participation and engagement in learning (Bierman et al., in pressa, b; Domitrovich, Cortes, & Greenberg, 2007; Fantuzzo et al., 2003; Webster-Stratton, Reid, & Hammond, 2004). These are precisely the behaviors that were most consistently affected by the Tulsa pre-K experience as captured in our outcomes of timidity, apathy, and attentiveness.

Implications for Policy and Practice

As the pressures on preschools to prepare children for school mount, there is growing recognition that this involves both exposure to pre-academic learning and support for the range of capacities that enable children to engage in learning, attend to instruction, interact effectively with teachers and peers, and manage themselves with growing independence in the classroom (Raver & Knitzer, 2002). This directs attention to early childhood interventions that focus explicitly on self-regulatory and attentional skills, and that attend to links between these behaviors and early learning. Fortunately, such approaches exist and are actively being refined for use with children who are making the transition from pre-K to kindergarten (see Diamond et al., 2007; Bierman et al., in press (a)(b); Raver et al., 2008, submitted). Much of this work has focused on Head Start classrooms. An important next step involves extending this work to state-funded pre-K programs more broadly and to the role that such interventions can play in promoting successful transitions to elementary school (see Bogard & Takanishi, 2005; Featherman & Phillips, submitted).

The evidence that high-quality pre-K education reduced timidity for both TPS and Head Start alumni is also important from a mental health perspective. The teacher ratings of timidity capture dimensions of a temperamental disposition known as social reticence (Fox et al, 2001; Rubin et al., 2006) which captures a pattern of fearful, withdrawn behavior that is a risk factor for later anxiety disorders (Ladd & Burgess, 2999; Tincas et al., 2006; Schwartz, 2003). Prior research has reported that exposure to group care settings contributes to discontinuity in social reticence over time (Fox et al., 2001). Our evidence suggests that exposure to peers in the context of emotionally supportive pre-K experiences may play a similar role for four- and five-year olds. Whether these experiences are powerful enough to disrupt worrisome pathways from early inhibition and fearfulness to subsequent anxiety disorders remains to be seen, but examinations of these types of pathways are highly deserving of empirical attention. This line of inquiry holds the potential to link what has been a highly educationally-oriented pre-K literature to an equally large body of empirical research on childhood mental health (National Scientific Council on the Developing Child, 2008). It also fits well within a framework that increasingly views emotional and behavioral problems seen in young children as arising in the context of transactions between children and the contexts in which they spent their early years (Cicchetti & Sroufe, 2000; Fantuzzo et al., 2003).

Limitations

There are several limitations to the current study. First, our exclusive reliance on teacher ratings of the children's social-emotional outcomes is not ideal. In particular, it is difficult to know how individual biases of various kinds may have affected the ratings. We have controlled for this, in part, through the use of teacher fixed effects. The addition

of more objective, observational measures of children's behavior would have strengthened our study still further. Second, because the teachers needed to be familiar with their students prior to making the ratings, as discussed above, we were not able to utilize the relatively rigorous RDD methodology used with our examination of cognitive outcomes (Gormley, Phillips, & Gayer, 2008) when examining this domain of outcomes. This increases the possibility that the inferences we draw from this study are threatened by the potential omission of unobserved variables. We did, however, analyze the cognitive outcomes using our propensity score methodology and found reasonably similar results to RDD, lending credibility to our propensity score matching technique (results available upon request). Third, our sample of low-income children was notably smaller than the total sample, making it more difficult to detect effects for this important subgroup. The high standard errors for the Head Start program's impact on social-emotional outcomes are also problematic. Fourth, it is important to keep in mind that Tulsa's early childhood education programs are not typical of early childhood education programs across the country. As a result, caution is needed in generalizing our findings to preschool or early childhood programs more generally.

Conclusion

Prior efforts to understand how early childhood settings affect the development of social-emotional competence have generated mixed findings and substantial controversy. This literature is only beginning to examine state-funded pre-K programs and, even within this type of setting, results have been inconsistent. This study adds to the literature by demonstrating clearly that state-funded pre-K programs can support the development of emerging social-emotional competences. The stronger capacities to pay

attention and to engage in rewarding interactions with teachers, and the lower levels of timidity and apathy among the children who attended the pre-K program suggest that these children are entering kindergarten better prepared to engage in learning than are their peers who did not attend pre-K. It is evident that even without any clear focus on attention or interpersonal skills, the good instruction and supportive emotional environments that characterize Tulsa's school-based pre-K classrooms (Phillips et al., 2008) are producing important advancements in social-emotional development.

It is difficult to generalize these findings from the relatively high-quality Tulsa pre-K program to other areas of the country or to other types of early childhood settings, and it may be the somewhat unusual features of the Tulsa program that account for the generally positive story told by our data. These include high teacher education requirements that are matched with relatively high salaries, strong community support for the program, and, within the classrooms, unusually strong attention to classroom management and high-quality feedback regarding learning. Whether it is these features of Tulsa's pre-K program or other aspects of teacher-child interactions or teacher management of peer interactions that account for the positive social-emotional impacts reported here is an important question for additional research in this area. In any event, the Tulsa pre-K program continues to offer the country a promising example of how to foster both cognitive and social-emotional development as children embark on their critically important journey through school.

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Table 1

Comparison of Assessed Children and the Universe of Children, Kindergarten

| Variable | Assessed children | | Universe | | |
|---------------------|-------------------|-------|----------|-------|----|
| | % | SD | % | SD | |
| Female | 0.477 | 0.500 | 0.474 | 0.499 | |
| <i>N</i> | | 3166 | | 4114 | |
| White | 0.361 | 0.480 | 0.347 | 0.476 | |
| Black | 0.299 | 0.458 | 0.309 | 0.462 | |
| Hispanic | 0.230 | 0.421 | 0.232 | 0.422 | |
| Native American | 0.097 | 0.296 | 0.100 | 0.299 | |
| Asian | 0.013 | 0.112 | 0.013 | 0.112 | |
| <i>N</i> | | 3144 | | 4059 | |
| Free lunch | 0.661 | 0.474 | 0.685 | 0.465 | ** |
| Reduced-price lunch | 0.105 | 0.307 | 0.098 | 0.298 | |
| Full-price lunch | 0.234 | 0.423 | 0.216 | 0.412 | |
| <i>N</i> | | 3142 | | 4061 | |
| No high school | 0.189 | 0.392 | 0.197 | 0.398 | |
| High school | 0.259 | 0.438 | 0.262 | 0.440 | |
| Some college | 0.390 | 0.488 | 0.387 | 0.487 | |
| College degree | 0.162 | 0.369 | 0.155 | 0.362 | |
| <i>N</i> | | 1953 | | 2155 | |
| Lives with Father | 0.597 | 0.491 | 0.592 | 0.492 | |
| <i>N</i> | | 2175 | | 2404 | |
| Internet | 0.511 | 0.500 | 0.502 | 0.500 | |
| <i>N</i> | | 2191 | | 2422 | |

*** Difference of means statistically significant at $p < 0.01$

** Difference of means statistically significant at $p < 0.05$

Table 2

Comparison of Observable Characteristics among matched Kindergartners with and without Exposure to Pre-K and CAP Head Start

| Variable | Tulsa Pre-K | | | CAP Head Start | | |
|---------------------------|-------------|-----------|---------|----------------|-----------|---------|
| | Comparison | Treatment | P-value | Comparison | Treatment | P-value |
| Age [†] | 180.75 | 183.21 | 0.584 | 195.11 | 188.81 | 0.479 |
| Free Lunch | 0.623 | 0.646 | 0.274 | 0.891 | 0.887 | 0.897 |
| Reduced Lunch | 0.13 | 0.125 | 0.752 | 0.07 | 0.056 | 0.503 |
| Paid Lunch | 0.247 | 0.229 | 0.323 | 0.04 | 0.056 | 0.342 |
| White | 0.379 | 0.364 | 0.459 | 0.132 | 0.113 | 0.457 |
| Black | 0.33 | 0.317 | 0.5 | 0.391 | 0.417 | 0.508 |
| Hispanic | 0.227 | 0.231 | 0.841 | 0.401 | 0.394 | 0.868 |
| Native American | 0.06 | 0.082 | 0.040** | 0.076 | 0.076 | 1 |
| Asian | 0.004 | 0.006 | 0.365 | N/A | N/A | N/A |
| Female | 0.501 | 0.481 | 0.354 | 0.507 | 0.503 | 0.935 |
| Mother No High School | 0.099 | 0.112 | 0.303 | 0.119 | 0.136 | 0.543 |
| Mother High School | 0.178 | 0.168 | 0.54 | 0.199 | 0.169 | 0.345 |
| Mother Some College | 0.238 | 0.233 | 0.766 | 0.209 | 0.185 | 0.475 |
| Mother College Up | 0.094 | 0.086 | 0.508 | 0.013 | 0.026 | 0.244 |
| Mother Education Missing | 0.392 | 0.401 | 0.636 | 0.46 | 0.483 | 0.569 |
| Lives with Father | 0.435 | 0.417 | 0.371 | 0.275 | 0.301 | 0.473 |
| Lives with Father Missing | 0.295 | 0.33 | 0.069* | 0.407 | 0.44 | 0.411 |
| Internet at Home | 0.382 | 0.352 | 0.137 | 0.189 | 0.192 | 0.918 |
| Internet at Home Missing | 0.292 | 0.326 | 0.083* | 0.417 | 0.437 | 0.622 |

*** Difference of means statistically significant at $p < 0.01$

** Difference of means statistically significant at $p < 0.05$

* Difference of means statistically significant at $p < 0.10$

[†] This variable is a measure of the number of days born before or after the September 1, 2001, birthday cutoff enforced by the Tulsa Public Schools and Tulsa Head Start programs for enrollment in their four-year-old programs in 2005-06. A positive value for age indicates that a child was born before the cutoff (eligible for enrollment), while a negative value indicates that a child was born after the cutoff (ineligible for enrollment).

Table 3

Results from OLS regression examining the effects on social-emotional development of participation in the TPS Pre-K and CAP Head Start programs, with teacher fixed effects, full matched sample

| | Tulsa Pre-K | | | CAP Head Start | | |
|------------------------|-------------|-------------------|--------|----------------|---------|--------|
| | Treatment | | Effect | Treatment | | Effect |
| | Effect | P-value | Size | Effect | P-value | Size |
| Socio-Emotional Factor | | | | | | |
| “Disobedient” | -1.08 | 0.854 | -0.01 | 0.039 | 0.975 | 0.00 |
| “Aggressive” | 0.161 | 0.773 | 0.02 | -0.06 | 0.965 | -0.01 |
| “Attention-Seeking” | -1.085 | 0.06 [†] | -0.11 | -0.288 | 0.767 | -0.03 |
| “Apathetic” | -1.231 | 0.048* | -0.12 | -0.952 | 0.494 | -0.10 |
| “Timid” | -1.549 | 0.008** | -0.15 | -2.723 | 0.019* | -0.22 |
| Attentiveness Index | 0.148 | 0.000*** | 0.19 | 0.143 | 0.157 | 0.17 |
| Treatment cases | 1,314 | | | 363 | | |
| % matched | 86% | | | 83% | | |
| Unique control cases | 582 | | | 184 | | |

Note: Models control for race/ethnicity, gender, mother's education, free lunch status,

whether the child lives with his/her father, and whether the child has home internet access

[†]<.10; *p<.05; **p<.01; ***p<.001

Table 4

Results from OLS regression examining the effects on social-emotional development of participation in the TPS Pre-K and CAP Head Start programs, with teacher fixed effects, free lunch matched sample

| | Tulsa Pre-K | | | CAP Head Start | | |
|------------------------|-------------|---------|--------|----------------|---------|--------|
| | Treatment | | Effect | Treatment | | Effect |
| | Effect | P-value | Size | Effect | P-value | Size |
| Socio-Emotional Factor | | | | | | |
| "Disobedient" | -0.248 | 0.728 | -0.02 | 0.707 | 0.575 | 0.07 |
| "Aggressive" | 1.19 | 0.141 | 0.12 | 0.598 | 0.679 | 0.06 |
| "Attention-Seeking" | -0.961 | 0.212 | -0.1 | -0.729 | 0.456 | -0.07 |
| "Apathetic" | -1.273 | 0.152 | -0.13 | -2.465 | 0.127 | -0.25 |
| "Timid" | -1.919 | 0.013* | -0.19 | -2.003 | 0.138 | -0.23 |
| Attentiveness Index | 0.09 | 0.006** | 0.22 | 0.160 | 0.121 | 0.21 |
| Treatment cases | 847 | | | 322 | | |
| % matched | 79% | | | 82% | | |
| Unique control cases | 339 | | | 159 | | |

Note: Models control for race/ethnicity, gender, mother’s education, whether the child lives with his/her father, and whether the child has home internet access

†p<.10; *p<.05; **p<.01; ***p<.001

Table 5

Results from OLS regression examining the effects on situtypes of participation in the TPS Pre-K and CAP Head Start programs, with teacher fixed effects, full matched sample

| Situtype | Tulsa Pre-K | | | CAP Head Start | | |
|------------------------------|-------------|--------------------|--------|----------------|--------------------|--------|
| | Treatment | | Effect | Treatment | P- | Effect |
| | Effect | P-value | Size | Effect | value | Size |
| Learning task problems | -0.905 | 0.083 [†] | -0.090 | -0.107 | 0.928 | -0.011 |
| Peer interaction problems | -0.676 | 0.193 | -0.068 | -0.447 | 0.725 | -0.045 |
| Teacher interaction problems | -1.354 | .020* | -0.135 | -2.472 | 0.053 [†] | -0.247 |
| Treatment cases | 1,126 | | | 302 | | |
| % matched | 86% | | | 83% | | |
| Unique control cases | 582 | | | 184 | | |

Note: Models control for race/ethnicity, gender, mother's education, free lunch status, whether the child lives with his/her father, and whether the child has home internet access

[†]p<.10; *p<.05; **p<.01; ***p<.001

Table 6

Results from OLS regression examining the effects on situtypes of participation in the TPS Pre-K and CAP Head Start programs, with teacher fixed effects, free lunch matched sample

| | Tulsa Pre-K | | | CAP Head Start | | |
|---------------------------|-------------|--------------------|--------|----------------|-------|--------|
| | Treatment | | Effect | Treatment | P- | Effect |
| | Effect | P-value | Size | Effect | value | Size |
| Situtype | | | | | | |
| Learning task problems | -1.238 | 0.092 [†] | -0.124 | -0.065 | 0.959 | -0.007 |
| Peer interaction problems | 0.389 | 0.602 | 0.039 | -0.514 | 0.69 | -0.051 |
| Teacher interaction | | | | | | |
| problems | -1.905 | .026* | -0.191 | -2.769 | 0.066 | -0.277 |
| Treatment cases | 847 | | | 322 | | |
| % matched | 79% | | | 82% | | |
| Unique control cases | 339 | | | 159 | | |

Note: Models control for race/ethnicity, gender, mother's education, whether the child

lives with his/her father, and whether the child has home internet access

[†]p<.10; *p<.05; **p<.01; ***p<.001

APPENDIX A

Differences between TPS Pre-K Alumni and Comparison Group on ASPI Items that Load

Highly on Apathy and Timidity Factors

Table A-1

Differences between TPS Pre-K Alumni and Comparison Group on ASPI Items that Load Highly on Apathy Factor

| | Factor | Proportion Answering "Yes" | | |
|------------------------------------------------|---------|----------------------------|-----------|-----|
| | | Loading | Non Alums | |
| Highly loading negative items | | | | |
| Listless, seems unmotivated | 0.545 | 4.37% | 3.72% | |
| Too lethargic to ask for help | 0.4867 | 2.71% | 1.67% | |
| Lacks interest, just sits | 0.4738 | 8.13% | 5.62% | * |
| Sluggish, apathetic in games | 0.4683 | 2.88% | 2.96% | |
| Appears to live in a dream world | 0.4603 | 8.39% | 7.52% | |
| Sits lifelessly during teacher directed time | 0.4499 | 4.46% | 3.42% | |
| Cannot work up the energy to face anything new | 0.4413 | 2.01% | 1.37% | |
| Distant, makes no relationship with teacher | 0.436 | 7.52% | 6.07% | |
| Lacks physical energy when working with hands | 0.4188 | 1.84% | 1.82% | |
| Seldom gets involved in any activities | 0.4054 | 3.67% | 3.19% | |
| Won't get involved in games | 0.4038 | 3.50% | 1.82% | * |
| Highly loading positive items | | | | |
| Gets along with two or more companions | -0.4172 | 79.46% | 84.66% | *** |
| Sticks to the activity when working with hands | -0.4187 | 69.76% | 74.26% | * |
| Participates easily in activities | -0.4202 | 75.96% | 78.82% | |

***Non alums and TPS alums different at $p < .001$; ** $p < .01$; * $p < .05$

Table A-2

Differences between TPS Pre-K Alumni and Comparison Group on ASPI Items that Load

Highly on Timidity Factor

| | Factor Loading | Proportion Answering "Yes" | | |
|------------------------------------------------|-------------------|----------------------------|-----------|---|
| | | Non Alums | TPS Alums | |
| Highly loading negative items | | | | |
| Shy, difficult to get to speak to teacher | 0.6205 | 8.83% | 8.73% | |
| Too timid to ask for help | 0.603 | 7.34% | 7.06% | |
| Shy but not unfriendly with teacher | 0.5928 | 18.53% | 18.45% | |
| Needs encouragement to join in games | 0.5333 | 14.34% | 12.22% | |
| Freezes up and doesn't answer questions | 0.4993 | 11.98% | 9.04% | * |
| Waits for teacher to greet first | 0.4757 | 28.58% | 27.79% | |
| Does not stand up for self during conflicts | 0.4524 | 12.33% | 9.64% | * |
| Sits so quietly you don't know if attending | 0.4445 | 7.26% | 5.09% | * |
| At times does not participate in activities | 0.436 | 19.67% | 19.74% | |
| Does not offer with jobs but likes to be asked | 0.4348 | 29.11% | 26.42% | |
| Appears too withdrawn to come forward for jobs | 0.4088 | 5.86% | 4.71% | |
| Never any trouble because so timid | 0.4065 | 3.67% | 2.58% | |
| Highly loading positive items | | | | |
| Has a happy-go-lucky attitude to every problem | -0.4428 | 40.56% | 42.29% | |
| Participates easily in activities | -0.5116 | 75.96% | 78.82% | |
| Willing or eager to help with jobs | -0.5493 | 63.64% | 67.50% | * |
| Greets teacher as most other students do | -0.5659 | 58.30% | 62.34% | * |
| Talks freely with teacher | -0.5789 | 68.36% | 69.70% | |
| Friendly, smiles readily at teacher | -0.603 | 69.58% | 71.91% | |

***Non alums and TPS alums different at $p < .001$; *** $p < .01$; * $p < .05$