Abstract Title Page
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Title: Inattention and Impulsivity: Differential Impact on School Readiness Capacities
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Abstract Body

Limit 5 pages single spaced.

Background / Context:

Description of prior research and its intellectual context.

The preschool years represent a critical period for children to develop the cognitive and social-behavioral readiness skills necessary to support school success (Blair, 2002; Raver, 2002; Campbell & von Stauffenberg, 2008; Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008). Unfortunately, many children lack these competencies, with a substantial achievement gap already apparent between children from low-income families and their middle-income peers at school entry (Campbell & von Stauffenberg, 2008). This gap continues to widen over time, contributing to differences in eventual educational attainment and long-term employment (Ryan, Fauth, & Brooks-Gunn, 2006), and making the improvement of school readiness a social and public policy concern (NICHD Early Child Care Research Network, 2003).

In responding to this need, developmental researchers have argued that intervention efforts must include a focus on the development of self-regulation (Shonokoff & Phillips, 2000). Considered a multi-faceted construct that includes the regulation of behavior, attention, and emotion, self-regulation skills set the stage for goal-oriented learning (Blair, 2002). When self-regulation skills are developing appropriately, children are better equipped to adjust to the learning and social-behavioral demands of the school environment (Blair & Diamond, 2008; Blair, 2002).

Purpose / Objective / Research Question / Focus of Study:

Description of the focus of the research.

Despite the conceptual link between self-regulation skills and school readiness capacities, questions remain regarding how distinct but related facets of self-regulation (i.e., attention regulation, behavior regulation) differentially impact the development of school readiness capacities during early childhood. Additionally, little is known about whether these distinct facets of self-regulation moderate children's responses to early interventions designed to target school readiness capacities.

The current study addresses these issues, by: 1) conducting factor analyses on teacher ratings of child inattention and impulsivity to validate the separate dimensions of attention and behavior regulation at pre-kindergarten, 2) evaluating the unique impact of teacher-rated inattention and impulsivity on specific school readiness skills and behaviors within the pre-kindergarten year, and 3) examining the moderation of intervention response based upon teacher-rated inattention and impulsivity.

In the present study, 44 Head Start classrooms were randomly assigned to an enriched intervention Head Start (Head Start REDI) or to "usual practice" classrooms. The enrichment program included Preschool PATHS Curriculum and components targeting language and emergent literacy skills. Assessments tracked the progress of 356 4-year-old children over the course of the pre-kindergarten and kindergarten years. It was hypothesized that children's initial attention and behavior regulation skills would influence children's acquisition of social-emotional and emergent literacy skills during the pre-kindergarten year, and would serve as moderators of child response to the REDI intervention.

Setting:
Description of the research location.

Head Start Programs in three Pennsylvania counties participated in this trial. Half of the participating classrooms came from a large, fairly densely populated county in the southeastern part of the state, which included an urban community surrounded by smaller communities. The other classrooms came from two smaller counties in the central part of the state, characterized by small towns and rural areas.

Population / Participants / Subjects:
Description of the participants in the study: who, how many, key features or characteristics.

Participants included two cohorts of four-year-old children (total N = 356, 19 percent Hispanic, 26 percent African-American; 55 percent European American; 54 percent girls) in 44 Head Start classrooms in three counties in Pennsylvania. These participants represent 86% of the initially eligible population, with most of the sample loss due to families who were not available for assessments or who moved prior to the completion of the pre-intervention assessments. At the time of assessment, children were, on average 4.59 years old (*SD* = .32, range = 3.87–5.82).

Intervention / Program / Practice:
Description of the intervention, program or practice, including details of administration and duration.

The intervention was delivered by classroom teachers and integrated into their ongoing classroom programs (High Scope or Creative Curriculum). The Preschool PATHS Curriculum (Domitrovich, Greenberg, Cortes, & Kusche, 1999) was used to promote children's social-emotional skills. This curriculum targets four domains: (a) prosocial friendship skills, (b) emotional understanding and emotional expression skills, (c) self-control (e.g., the capacity to inhibit impulsive behavior and organize goal-directed activity), and (d) problem-solving skills, including interpersonal negotiation and conflict resolution skills. Teachers presented skill concepts during circle time and coordinated extension activities provided opportunities for skill practice. Teachers were also encouraged to use positive classroom management practices, "emotion coaching," and induction strategies to support appropriate self-control.

In addition, four language and emergent literacy skills were targeted in REDI: (a) vocabulary, (b) syntax, (c) phonological awareness, and (d) print awareness. Three components were developed to target these skills, including an interactive reading program, a set of "Sound Games," and print center activities.

Teachers attended training workshops (a total of 4 days) and received weekly mentoring that was provided by local educational consultants Extensive monitoring of program implementation indicated that teachers were able to deliver the intervention with relatively high levels of fidelity (see Bierman, Domitrovich, Nix, Gest, Welsh, et al., 2008 for details).

Research Design:
Description of research design (e.g., qualitative case study, quasi-experimental design, secondary analysis, analytic essay, randomized field trial).

Using a stratified randomization process, classes were divided into groups based on demographic characteristics of the population served, location (e.g., central or southeastern Pennsylvania), and length of school day (e.g., full day, half day, year round). Classrooms in the same center were always assigned to the same condition, to avoid inadvertent contamination of condition within centers. Within stratified groups, centers were randomly assigned to intervention or control conditions. Although classrooms contained 3- and 4-year-old children, only 4-year-olds participated in this evaluation. Prior to the trial, some children had attended Head Start as 3-year-olds (58% in the intervention, 61% in the control condition). Pretest scores for all children were used to control statistically for initial differences in child skills.

Data Collection and Analysis:

Description of the methods for collecting and analyzing data.

The data used in these analyses were collected at two time points: 1) the beginning of the pre-kindergarten year, as soon as children had acclimated to the Head Start classroom setting and 2) the end of the kindergarten year. In the pre-kindergarten year, one lead and one assistant teacher in each classroom provided independent ratings of child behavior. In April of kindergarten, teachers were asked to complete ratings on each child in the study. Teachers were compensated $20 to provide general information about themselves and their classrooms, and they received an additional $7 per child for completing behavioral ratings. Parent interviews were initiated shortly before the start of the pre-kindergarten school year and continued through the end of October. Parents were re-interviewed at the end of the kindergarten school year, in May and June. Each time, parents were compensated $20 for this 30-min interview. Child assessments were conducted at school by trained interviewers, during two individual "pull-out" sessions (30-45 min each). End of the kindergarten year child assessments were conducted in March and April. A multimethod, multimeasure assessment battery included child assessments, teacher ratings, and parent ratings. School readiness measures represented two core domains: (1) cognitive skills: language and emergent literacy, and (2) (d) behavioral adjustment: socially competence and aggressive behaviors.

Language skills. Three tests were administered directly to children to assess their language skills. In the Expressive One-Word Picture Vocabulary Test (EOWPVT; Brownell, 2000), children gave the word that best described pictures they were shown ($\alpha = .94$). The Grammatical Understanding subtest of the Test of Language Development (TOLD; Newcomer & Hammill, 1997) assessed syntax comprehension. Children listened to a sentence and chose one of the four pictures that "best matched" the meaning of the sentence ($\alpha = .80$). The Sentence Imitation subtest assessed syntax expression. Children repeated sentences read aloud by the interviewer. Scores reflected the number of increasingly complex sentences a child imitated correctly. Scores on the Grammatical Understanding and Sentence Imitation subtests were combined to form a total syntax score ($r = .36$, $p < .01$).

Emergent literacy skills. Three subscales assessing emergent literacy skills were drawn from the Test of Preschool Early Literacy (TOPEL; previously Pre-CTOPP; Lonigan, Wagner, Torgesen, & Rashotte, 2007). The Blending subtest assessed phonological processing. Children were asked to combine different parts of a word, such as "hot" and "dog" or "b" and "air" and point to the correct picture or say the full word ($\alpha = .86$). On the Elision subtest, children deconstructed compound words and pointed to the correct picture (e.g., Point to "snowshoe" without "snow"; Say "airport" without "air"; $\alpha = .83$). Scores on the Blending and Elision

subtests were combined to form a total phonemic awareness score ($r = .35$, $p < .01$). In the Print Knowledge subtest, children identified pictures of letters or words and named letters ($\alpha = .97$).

Social-emotional behaviors. Teacher ratings and parent ratings assessed social competence and aggressive-oppositional behavior. The 13 items of the Social Competence Scale (Conduct Problems Prevention Research Group [CPPRG], 1995) were rated on a 6-point Likert scale (*never* to *always*) and included prosocial behaviors such as sharing, helping, understanding other's feelings, as well as self-regulatory behaviors, such as resolving peer problems independently. Ratings provided by lead and assistant teachers in pre-kindergarten were averaged ($r = .56$, $p < .001$). Internal consistency was high for teachers ($\alpha = .87$).

Seven items from the Teacher Observation of Child Adaptation – Revised (TOCA – R; Werthamer-Larsson, Kellam, & Wheeler, 1991) assessed overt aggression (e.g., stubborn, yells, fights). Six items from the Preschool Social Behavior Scale – Teacher Form (Crick, Casas, & Mosher, 1997) assessed relational aggression (e.g., "Tells other kids he/she won't be their friend unless they do what he/she wants"). Items were rated on a 6-point Likert scale (*almost never* to *almost always*; $\alpha = .88$ and .93, for the two scales, respectively). Ratings from lead and assistant teachers in pre-kindergarten were averaged ($r = .68$, $p < .001$, for overt aggression, and $r = .51$, $p < .001$, for relational aggression), and overt and relational aggression were combined to form a total aggression score ($r = .58$, $p < .001$). Parents completed the seven items from the TOCA – R only ($\alpha = .86$, $\alpha = .92$, respectively).

Attention and behavior regulation. Teacher ratings of inattention were used to assess attention regulation, using five items from the inattention subscale of the ADHD Rating Scale (DuPaul, 1991; e.g., "Is easily distracted," "Has trouble staying focused") and three items from an inventory developed for this study (e.g., "Is careful with his or her work"). Ratings from lead and assistant teachers in pre-kindergarten were averaged ($r = .723$, $p < .01$, for items from the ADHD Ratings Scale), and items from the two scales were combined to form a total inattention score ($\alpha = .96$), reflecting attention regulation. Five items from the impulsivity subscale of the teacher-rated ADHD Rating Scale (e.g., "Blurts out answers inappropriately," "Has trouble waiting his/her turn") were used to assess behavior regulation. Ratings from lead and assistant teachers in pre-kindergarten were averaged ($r = .74$, $p < .01$) and a total impulsivity scale was formed ($\alpha = .95$).

Findings / Results:

Description of the main findings with specific details.

Confirming Dimensions of Self-Regulation

It was hypothesized that the teacher-rated items measuring facets of self-regulation would show domain specificity, forming inter-related by distinct clusters of items based upon the degree to which the items reflected inattention or impulsivity. To test this hypothesis, the self-regulation items were subjected to a principal components factor analysis (varimax rotation with Kaiser normalization). As expected, two factors emerged with Eigenvalues greater than 1.0. The first factor had an Eigenvalue of 6.13, and explained 47.2% of the variance. It was defined by the items representing inattention. The second factor had an Eigenvalue of 4.70 and explained 36.2% of the variance. It was defined by the items reflecting impulsivity. Together this two-component structure accounted for 83% of the total variance, and no measure loaded above .57 on the two factors simultaneously (see Table 1).

Associations with School-Readiness

Next, correlations and partial correlations were computed to examine relations between inattention and impulsivity and concurrent school readiness skills and behaviors (see Table 2). Inattention and impulsivity showed distinctive patterns of association with impairment in cognitive and behavioral domains. Consider first the cognitive domain. Inattention was associated with reduced cognitive performance on all of the measures of language and emergent literacy skills (range of *r* from-.21 to -.29). Partialling out impulsivity did not reduce these correlations, and sometimes increased them. In contrast, impulsivity was not significantly associated with any of the measures of language or emergent literacy skills. When inattention was controlled, the relation between impulsivity and cognitive functioning became positive, suggesting that heightened impulsivity (when not accompanied by inattention) was associated with better cognitive performance (see Table 2).

Quite a different pattern emerged for the measures reflecting behavioral functioning — social competence and aggression. Simple correlations revealed that inattention was strongly associated with teacher ratings of reduced social competence and elevated aggression, and mildly associated with parent ratings of reduced social competence and elevated aggression. Partialling out impulsivity reduced the association in the teacher ratings, suggesting that concurrent impulsivity was increasing the behavioral impairment associated with inattention. However, even with impulsivity controlled, inattention remained significantly associated with low social competence and elevated aggression by both teacher and parent report. Like inattention, impulsivity was also strongly associated with teacher ratings of reduced social competence and elevated aggression. However, impulsivity was not associated with parent ratings of social competence and aggression. After partialling out inattention, impulsivity was no longer significantly associated with teacher-rated social competence, suggesting that concurrent inattention was driving the association with reduced social competence. Despite partialling out inattention, impulsivity remained significantly associated with teacher ratings of aggression. Interestingly, partialling out inattention resulted in an increased association between impulsivity and an elevated parent-rated social competence (see Table 2).

To clarify these findings and further explore the school readiness difficulties associated with inattention and impulsivity, the sample was divided using median splits into groups of children who showed elevations in one, both, or neither dimension of impulsivity and inattention, resulting in four groups: inattentive-only, impulsive-only, inattentive-impulsive, and normative. ANOVAs were conducted on each of the school readiness measures to explore group differences. For measures in the cognitive domain, significant group differences emerged on measures of vocabulary, $F(3, 348) = 9.88$, $p < .001$, syntax, $F(3, 348) = 6.92$, $p < .001$, print awareness, $F(3, 348) = 6.24$, $p < .001$, and phonemic awareness, $F(3, 348) = 9.48$, $p < .001$. Post-hoc comparisons (Tukey) revealed that the inattentive-only group performed more poorly than the normative and impulsive-only groups on each of the cognitive measures. In addition, children in the inattentive-impulsive group performed significantly more poorly than the normative and impulsive-only groups on syntax and more poorly than the normative group on print awareness and phonemic awareness. In contrast, children who were impulsive only (without elevated inattention) did not show any language or emergent literacy skill delays – they scored equivalent to the children in the normative group on all measures (see Figure 1). ANOVAs on the behavioral measures revealed significant group differences on teacher ratings of social competence, $F(3, 348) = 113.33$, $p < .001$, teacher ratings of aggression, $F(3, 348) = 103.07$, $p < .001$, and parent ratings of aggression, $F(3, 348) = 3.23$, $p < .05$, but not on parent ratings of social competence, $F(3, 348) = 1.79$, $p < .15$. Post-hoc comparisons (Tukey) revealed

that on teacher ratings of social competence and aggression, the inattentive-impulsive group performed significantly more poorly than any of the three other groups. The inattentive-impulsive group also performed more poorly than the normative group on parent ratings of aggression. Additionally, the inattentive-only group performed more poorly than the normative and impulsive-only groups on teacher-rated social competence, and more poorly that then normative group on teacher ratings of aggressive behavior. As with the measures of language and literacy, the impulsive-only group did not differ significantly from the normative group on any of the measures in the behavioral domain (see Figure 2).

Conclusions:

Description of conclusions, recommendations, and limitations based on findings.

Overall, these findings suggest that during the preschool years, it is important to differentiate between attentional and behavioral regulation difficulties. In this study, children who had isolated difficulties with behavioral regulation and showed elevated impulsivity alone (without inattention), performed in the normative range on school readiness measures that reflected cognitive (language, emergent literacy) and behavioral (social competence, aggression) functioning. In contrast, children who had difficulties with attention regulation, and showed elevated inattention alone (without impulsivity) were at considerable risk, exhibiting significant delays in the acquisition of language and emergent literacy skills, the acquisition of social competencies, and the control of aggressive behaviors. Children who had difficulties in both areas (impulsivity and inattention) also showed deficits across the cognitive and behavioral domains, with behavioral difficulties that were more extreme than children with inattention only. At this point, all analyses were cross-sectional, making conclusions about the impact on school adjustment only tentative. The next step in this study will be to conduct predictive analyses, examining the impact of inattention and impulsivity on children's functioning in kindergarten. In addition, we will examine intervention effects to determine whether pre-intervention levels of inattention or impulsivity moderated the impact of the REDI intervention.

Appendices

Not included in page count.

Appendix A. References

References are to be in APA version 6 format.

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Appendix B. Tables and Figures
Not included in page count.

Table 1
Factor Loadings for Teacher Ratings of Inattention and Impulsivity

Item	Inattention	Impulsivity
<u>Inattention Scale</u>		
Has the self-control necessary to do well in school - R	**.79**	.39
Is careful with his or her work - R	**.89**	.20
Can work independently - R	**.90**	.19
Is easily distracted	**.78**	.46
Has trouble staying focused	**.82**	.41
Goes from one uncompleted activity to another	**.78**	.41
Doesn't seem to listen	**.75**	.52
<u>Impulsivity Scale</u>		
Has trouble waiting for his or her turn	.57	**.70**
Blurts out answers or opinions inappropriately	.32	**.89**
Has trouble playing or doing things quietly	.51	**.77**
Talks too much	.20	**.90**
Interrupts or intrudes on others	.37	**.87**

Note. Varimax rotation was used. Reverse-scored items are indicated with an R. Boldface items indicate the subscale scoring.

Table 2
Correlations and Partial Correlations Between Inattention and Impulsivity (in Pre-Kindergarten) and School Readiness Skills and Behaviors

	Inattention		Impulsivity	
	Pearson	Partial[a]	Pearson	Partial[b]
Language skills				
Vocabulary	-.21**	-.32**	.02	.27**
Syntax	-.26**	-.26**	-.09	.14**
Emergent Literacy				
Blending/Elision	-.29**	-.35**	-.07	.24**
Print awareness	-.23**	-.30**	-.04	.21**
Social-emotional behaviors				
Social competence: Teachers	-.79**	-.57**	-.65**	-.10
Aggression: Teacher	.75**	.36**	.77**	.46**
Social competence: Parent	-.14**	-.18**	-.03	.12*
Aggression: Parent	.19**	.18**	.10	-.08

[a] Control variable was Impulsivity
[b] Control variable was Inattention
** $p < .001$; **$p < .01$; *$p < .05$

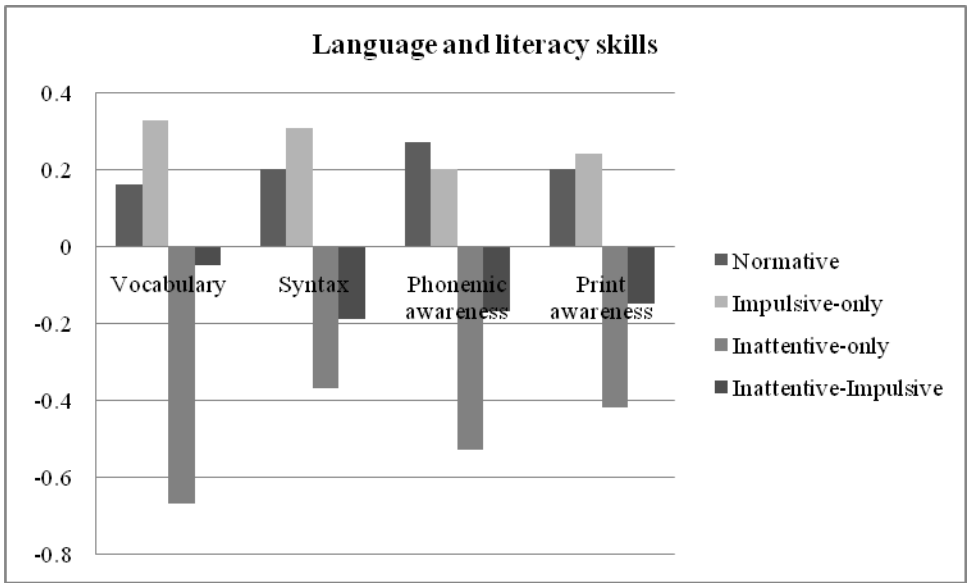

Figure 1. Group differences on language and literacy skills.

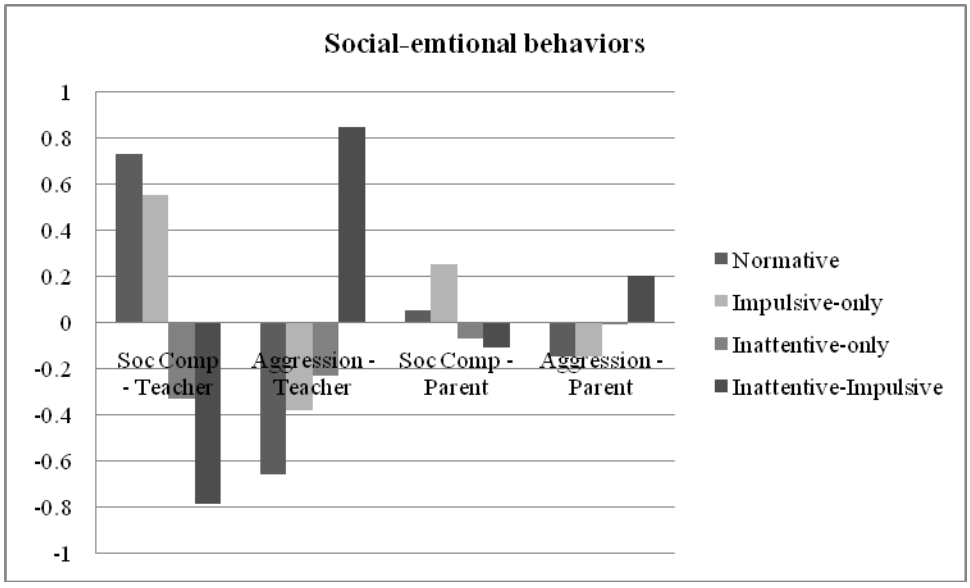

Figure 2. Group differences on social-emotional behavoirs.
Note: Soc Comp, social competence