Attachment and Effortful Control in Toddlerhood Predict Academic Achievement Over a Decade Later

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Abstract

A child's attachment to his or her caregiver is central to the child's development. However, current understanding of subtle, indirect, and complex long-term influences of attachment on various areas of functioning remains incomplete. Research has shown that (a) parent-child attachment influences the development of effortful control and that (b) effortful control influences academic success. The entire developmental cascade among these three constructs over many years, however, has rarely been examined. This article reports a multimethod, decade-long study that examined the influence of mother-child attachment and effortful control in toddlerhood on school achievement in early adolescence. Both attachment security and effortful control uniquely predicted academic achievement a decade later. Effortful control mediated the association between early attachment and school achievement during adolescence. This work suggests that attachment security triggers an adaptive cascade by promoting effortful control, a vital set of skills necessary for future academic success.

Keywords

effortful control, attachment, academic performance, longitudinal, temperament

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Research suggests that school achievement is a function of both intellectual and nonintellectual strengths (e.g., La Paro & Pianta, 2000; Liew, McTigue, Barrois, & Hughes, 2008; Swanson, Valinette, Lemery-Chalfant, Bradley, & Eggum-Wilkens, 2014). However, far less research has examined long-term cascades, anchored in early childhood experiences, that ultimately lead to academic achievement. Investigations of developmental cascades linking early deficits or strengths to outcomes much later in development are critically important given their potential to (a) isolate key domains in early childhood that trigger adaptive or maladaptive cascades and (b) clarify the subsequent mechanisms unfolding over time that ultimately affect development. Such research has the potential to elucidate how best to interrupt negative cascades—and promote positive cascades. It thus has

important implications not only for theory but also for interventions aimed at promoting healthy child development (Masten & Cicchetti, 2010).

The quality of children's relationships with caregivers is one key consideration in early childhood (Bowlby, 1969). A child's attachment to his or her caregiver is a vital process and has widespread implications for a range of socioemotional outcomes (e.g., Kim, Boldt, & Kochanska, 2015; Laible, Carlo, Davis, & Karahuta, 2016). Thus, it is not surprising that attachment security

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has implications for such achievement-relevant variables as preacademic reading skills in preschool years (e.g., Bus, Belsky, van IJzendoorn, & Crnic, 1997) and mastery motivation and cognitive engagement in early school years (e.g., Moss & St-Laurent, 2001). Nonetheless, most research spans only a few years, typically from preschool to the first years of school. Thus, the long-term impact (e.g., into adolescence) of attachment on academic achievement is unclear.

Further, the mechanisms through which attachment ultimately influences academic achievement have received limited attention and warrant closer examination. Researchers have postulated that attachment security promotes (a) receptivity to influence and (b) good coping and emotion-regulation skills, which in turn support cognitive and learning activities (Bergin & Bergin, 2009); however, these postulates have not been tested empirically. Attachment may also influence academic achievement through its effect on the development of a child's ability to inhibit a dominant response voluntarily and to activate a subdominant response (i.e., effortful control; Kochanska, Murray, & Harlan, 2000; Rothbart & Bates, 2006). It is important to examine this possibility, because effortful control appears to be a key variable in a range of developmental outcomes, including academic success in early school years (Liew et al., 2008; Swanson et al., 2014). Further, research has demonstrated that attachment security plays a pivotal role in the development of self-regulatory skills (e.g., Kochanska, 2001), which suggests that parent-child attachment may trigger a cascade that influences academic achievement much later in development via effortful control. We now examine each element of this proposed cascade more closely.

Effortful Control Predicts Academic Achievement

Effortful control shares features with constructs that are arguably better established and have longer histories in the scientific narrative. For example, the ability to *delay gratification* (Mischel & Ebbesen, 1970) is a central component of behavioral batteries of effortful control (Carlson, 2005; Kochanska et al., 2000). Compared with other personality dimensions, *conscientiousness* (i.e., a tendency to be organized and self-disciplined on the one hand as opposed to disorganized or careless on the other) has the highest correlation with effortful control (Rothbart & Bates, 2006). Further, some consider *emotion regulation* to be closely related to effortful control in childhood (Eisenberg, Smith, & Spinrad, 2011).

Evaluated from this broader perspective, effortful control (and related constructs) predict academic achievement over and above the effects of more traditional

aptitude-based predictors such as intelligence (Duckworth & Seligman, 2005; Nofle & Robins, 2007). Yet effortful control has been linked only to academic achievement 1 or 2 years later, with one exception: In a classic study by Mischel, Shoda, and Peake (1988), delay of gratification at age 4 predicted better academic functioning a decade later. There are two prevailing hypotheses regarding why effortful control affects achievement. First, children with low effortful control tend to procrastinate on tasks, spend less time attending to tasks, and receive less instruction and feedback from teachers, whereas children high in effortful control have qualities that promote school learning (e.g., ability to focus on work, better attention for longer periods of time, voluntary control of behavior; Tice & Baumeister, 1997). Second, effortful control promotes better social competency and fewer behavior problems, which "frees up" resources to meet academic challenges, which in turn promotes academic success (Valiente et al., 2011).

A Cascade From Attachment to Academic Achievement via Effortful Control

As noted, attachment security promotes (a) receptivity to influence and (b) good coping and emotion-regulation skills, which in turn support learning activities (Bergin & Bergin, 2009). Further, evidence increasingly indicates that effortful control can be modulated by the quality of the attachment relationship (Kochanska, 2001; Viddal, Berg-Nielsen, Wan, Green, Hygen, & Wichstrøm, 2015) and should not be viewed as static (Kochanska & Kim, 2013).

As discussed previously, effortful control appears to be an important predictor of future achievement (Bergin & Bergin, 2009; Valiente et al., 2011). For example, Swanson et al. (2014) demonstrated that effortful control mediated the effects of positive parenting on achievement between kindergarten and the second grade, which provides support for this pathway in early childhood. Collectively, the evidence suggests that one key pathway leading to adolescent academic achievement may lead from the quality of formative relationships with parents to children's effortful control to achievement. However, this pathway has yet to be tested across multiple stages of development.

In summary, attachment security has far-reaching implications for emotion and self-regulation (Cassidy, 1994; Eisenberg et al., 2011; Sroufe, 2005); however, the current understanding of how attachment exerts its influence on various areas of functioning—and how it initiates long-term cascades, leading to important outcomes of interest (e.g., academic achievement)—remains incomplete. The aim of the current study was to examine

the extent to which early attachment security may trigger a cascade leading to academic success in adolescence by influencing effortful control. To achieve this goal, we used a multimethod design—including standardized behavioral laboratory tasks; nationally standardized, norm-referenced achievement test scores; and maternal reports—spanning over a decade of development from toddlerhood to adolescence.

Method

Overview of the longitudinal design

Attachment was assessed when the children were between 2 and 3 years old, and effortful control was assessed at age 3. When the children were between 11 and 15 years old, a separate research team (the current authors) obtained information about the socioemotional and academic functioning of the children from various sources. Effortful control and mother-child attachment security during toddlerhood were examined as predictors of academic achievement in early adolescence, which was measured with standardized national test results in math and reading as well as maternal ratings of scholastic competencies. Further, the potential mediating role of effortful control in the link between mother-child attachment security and adolescent academic achievement was examined.

Participants

Participating families were recruited from two separate longitudinal studies of infancy and toddlerhood initiated by Kochanska (1997, 2001). The first sample consisted of 103 children first recruited at the ages of 2 or 3 years (mean age = 32.9 months, $SD = 4.09$; 51 girls); the second sample consisted of 112 children first recruited at the age of 9 months (mean age = 8.94 months, $SD = 0.63$; 56 girls). Both samples were mostly White (> 80%), most came from intact families ($\geq 85\%$ intact at recruitment), and all children were born full term. Maternal age was comparable in the two samples (first sample: mean age = 32 years; second sample: mean age = 31 years). Educational attainment and family income were diverse. Maternal educational attainment was distributed as follows in the first and second samples, respectively: 12% and 26% had high school education, 20% and 15% had some college, and 68% and 59% had college or postgraduate education. Family income for the first sample was distributed as follows: 13% earned less than \$15,000, 13% earned \$15,000 to \$24,999, 14% earned \$25,000 to \$34,999, 22% earned \$35,000 to \$44,999, and more than 38% earned \$45,000 or more. Family income for the second sample was

distributed as follows: 7% earned less than \$20,000, 13% earned \$20,000 to \$29,999, 20% earned \$30,000 to \$39,000, 17% earned \$40,000 to \$49,999, 17% earned \$50,000 to \$59,999, and 26% earned \$60,000 or more.

Procedure

Toddlerhood. Attachment measures were obtained when the children were 3 years old for the first sample and when the children were 2 years old for the second sample. For both samples, measures of effortful control were obtained when the children were 3 years old (first sample: mean age = 32.9 months, $SD = 4.09$; second sample: mean age = 32.8 months, $SD = 0.53$). During these assessments, the children and their mothers were observed in structured behavioral assessments for 2- to 3-hr periods.

Adolescence. For the follow-up assessments at adolescence, children from the first and second samples were, 14 or 15 years old and 11 or 12 years old, respectively. Sixty-nine mother-child dyads from the first sample participated in the follow-up assessments (67.0%; 54 dyads came to the laboratory), 27 dyads could not be located, and 8 dyads declined participation. Seventy-seven mother-child dyads from the second sample participated in the follow-up assessments (68.8%; 56 dyads came to the laboratory), 26 dyads could not be located, and 9 dyads declined participation. Fifty-two percent of the children were girls, and 92% were White.

Measures

Behavioral effortful control. The behavioral battery used to assess effortful control was similar in the two samples and included multitrial tasks that assessed the functions and capacities that are the most prototypical for effortful control (Kochanska et al., 2000; Rothbart & Bates, 2006). These included voluntary slowing down of motor activity (Slow Turtle & Fast Rabbit task), suppression and initiation of activity to signal (Tower task), and delaying gratification (Snack Delay task, Tongue task, and two Gift Waiting tasks). The task-specific scores were aggregated across trials for each task and then standardized and aggregated into a single robust and internally coherent score of effortful control (Cronbach's α values ranged from .75 to .84).

Parental reports of effortful control. Mothers completed the Child Behavior Questionnaire (CBQ; Rothbart & Bates, 2006), a well-established parent-report measure of temperament for 3- to 7-year-old children. Items were rated on scale from 1 (*extremely untrue*) to 7 (*extremely true*). We used the Inhibitory Control scale of the CBQ (13 items; Cronbach's $\alpha = .82$ and .89 in the first and

Table 1. Means and Standard Deviations of the Study Variables and Comparison of the Two Samples

Variable	Sample 1		Sample 2		Overall		Comparison of the samples ^a	
	Mean (SD)	<i>n</i>	Mean (SD)	<i>n</i>	Mean (SD)	<i>n</i>	<i>t</i> tests	Cohen's <i>d</i>
Toddlerhood (ages 2–3)								
Attachment security (AQS)	.42 (.31)	102	.48 (.20)	107	.45 (.26)	209	<i>t</i> (207) = 1.80	.23
Effortful control								
Reported by mothers (CBQ)	4.78 (4.58)	103	4.85 (0.51)	105	4.81 (0.55)	208	<i>t</i> (206) = 0.84	.13
Observed/behavioral	.00 (.48)	103	.00 (.51)	102	.00 (.49)	205	—	—
Adolescence (ages 11–15)								
ITBS and ITED: reading	82 (18)	51	75 (23)	55	79 (21)	106	<i>t</i> (104) = 1.80	–.34
ITBS and ITED: math	80 (19)	51	75 (25)	56	77 (22)	107	<i>t</i> (105) = 1.20	–.22
CBCL: Scholastic competencies	50 (7)	67	48 (7)	75	49 (7)	142	<i>t</i> (140) = 1.60	–.29

Note: AQS = Attachment Q-set (Waters & Deane, 1985); ITBS = Iowa Test of Basic Skills (Hoover, Dunbar, & Frisbie, 2001); ITED = Iowa Test of Educational Development (Feldt, Forsyth, Ansley, & Alnot, 1993); CBCL = Child Behavior Checklist (Achenbach & Rescorla, 2001); CBQ = Child Behavior Questionnaire (Rothbart & Bates, 2006).

^a*p* > .05 for all between-samples comparisons.

second samples, respectively) in the current report because this scale maps most closely to the content of the laboratory effortful-control measures (Kochanska et al., 2000).

Security of attachment. Mothers completed the Attachment Q-Set (AQS; Waters & Deane, 1985), a widely used measure of children's security of attachment (Van IJzendoorn, Vereijken, Bakermans-Kranenburg, & Riksen-Walraven, 2004). For each child, a correlation was computed between the mother's sorting of cards (each listing a specific behavioral characteristic of children between the ages of 24 and 48 months) and the prototypical secure-attachment criterion scores provided by Waters and Deane (1985). These correlations were then standardized using Fisher's *r*-to-*z* transformation (Van IJzendoorn et al., 2004). Higher scores indicate greater attachment security.

Academic achievement. At follow-up, academic achievement scores were obtained, and competence was assessed. Academic achievement was measured by nationally standardized, norm-referenced achievement tests from the Iowa Testing Program: the Iowa Test of Basic Skills (ITBS; Hoover, Dunbar, & Frisbie, 2001) and the Iowa Test of Educational Development (ITED; Feldt, Forsyth, Ansley, & Alnot, 1993). Mothers provided copies of their children's ITBS or ITED scores in math and reading. In addition to these objective measures, mothers provided ratings on the Scholastic Competence Scale from the Child Behavior Checklist (Achenbach & Rescorla, 2001), which includes ratings of child performance in school, reports of remedial educational services, grade repetition, and other difficulties. Raw scores were converted to normalized T scores (*M* = 50, *SD* = 10) using norms for age and sex

from Achenbach and Rescorla (2001). This measure has been used extensively with normal, clinical, and pediatric populations and has established validity and reliability for childhood competency and difficulty.

Statistical analysis

Longitudinal data were analyzed using Mplus (Muthén & Muthén, 2012). Because of attrition across the repeated assessments, spanning more than a decade, some adolescent achievement scores were missing (e.g., covariance coverage for the primary mediation model ranged from .50 to .99; for *n* at each assessment, see Table 1). However, there were no significant differences in toddlerhood attachment, *t*(207) = –1.30, *p* = .194, or toddlerhood effortful control, *t*(203) = 0.07, *p* = .931, as a function of attrition status from toddlerhood to adolescence. Consistent with contemporary theories of missing data (Enders, 2010), we adopted the “gold standard” approach of using full-information maximum likelihood estimation, which is preferred over more traditional approaches to addressing missing data (e.g., pairwise deletion) when missing data rates are elevated. Indeed, simulation studies demonstrate its utility even when rates of missingness are relatively substantial (e.g., > 50%; Enders, 2010).

Multiple indices were used to assess global model fit. The comparative fit index (CFI), Tucker-Lewis Index (TLI), root-mean-square error of approximation (RMSEA), and standardized root-mean residual (SRMR) are reported. Once a model was deemed to fit the data adequately, parameter estimates were interpreted. Mediation was tested using bootstrapping (Shrout &

Table 2. Correlations Among Temperament and Attachment Security in Toddlerhood and Achievement and Scholastic Competence in Early Adolescence

Variable	1	2	3	4	5
Early childhood (ages 2–3)					
1. Observed/behavioral effortful control	—				
2. Effortful control reported by mothers (CBQ)	.44**	—			
3. Attachment security (AQS)	.19*	.28**	—		
Adolescence (ages 11–15)					
4. ITBS and ITED: reading	.27**	.27**	.16	—	
5. ITBS and ITED: math	.10	.20*	.16	.56**	—
6. CBCL: scholastic competence	.19*	.18*	.24**	.43**	.54**

Note: Correlations of moderate to large magnitude are in boldface type. CBQ = Child Behavior Questionnaire (Rothbart & Bates, 2006); AQS = Attachment Q-set (Waters & Deane, 1985); ITBS = Iowa Test of Basic Skills (Hoover, Dunbar, & Frisbie, 2001); ITED = Iowa Test of Educational Development (Feldt, Forsyth, Ansley, & Alnot, 1993); CBCL = Child Behavior Checklist (Achenbach & Rescorla, 2001).

* $p < .05$ (two-tailed). ** $p < .01$ (two-tailed).

Bolger, 2002), which provides an empirical approximation of sampling distributions of indirect effects. We performed a nonparametric resampling method (bias-corrected bootstrap) with 5,000 resamples drawn to derive the 95% confidence intervals (CIs) for the indirect effects (Preacher, Rucker, & Hayes, 2007). Note that a bootstrap approach performs well in relatively small samples, maximizing the power and maintaining Type I error rate (Shrout & Bolger, 2002).

Mother reports and observed measures of effortful control were modeled as indicators of a latent effortful-control variable. Scholastic competence and reading and math test scores were modeled as indicators of the latent academic-achievement variable. The metric of the latent variables was set by fixing the variance of the latent variables to 1.00; thus, latent scores were standardized.

Results

Analysis of the full data set showed that differences between the two cohorts with regard to mean scores of study variables were small and nonsignificant (Table 1). Consequently, the remaining analyses were based on the combined 210 mother-child dyads across cohorts. This provided a sample large enough to incorporate latent variables of constructs into the models (Barrett, 2007), which reduced measurement error.

Associations among measures

Correlations among concurrent measures are shown in Table 2, and all were in the expected direction. The strongest association among toddlerhood variables was between the behavioral and mother-reported measures of effortful control ($r = .44$). Security of mother-child

attachment was positively and significantly associated with effortful control (average $r = .24$). As expected, intercorrelations among objective measures of early-adolescent achievement and maternal ratings of scholastic competence were robust (average $r = .51$).

Table 2 also presents the correlations of effortful control and attachment security in toddlerhood with school achievement in adolescence. Effortful control at age 3 was significantly associated with better achievement and scholastic competence in early adolescence (average $r = .20$). Finally, security of attachment in toddlerhood showed modest associations with scholastic competencies in adolescence.

Results of structural equation modeling

A measurement model comprising both latent variables demonstrated excellent global fit (CFI = .987, TLI = .968, RMSEA = 0.044, SRMR = .034). The model explained a significant percentage of the variance in each indicator of achievement: 51% for reading (ITBS and ITED; factor loading = .71), 63% for math (ITBS and ITED; factor loading = .80), and 45% for scholastic competencies (Child Behavior Checklist; factor loading = .67). The model also explained a significant percentage of the variance in each indicator of effortful control: 51% for effortful control (CBQ; factor loading = .72) and 38% for behavioral effortful control (factor loading = .62). There was a significant association of moderate magnitude between the two latent variables, $r = .40$ ($SE = .125$), $p = .001$.

Figure 1 presents results from preliminary models establishing that (a) attachment in toddlerhood significantly predicts achievement in adolescence (Model 1) and (b) effortful control in toddlerhood significantly

Model 1: Attachment

Model 2: Effortful Control

Fig. 1. Structural equation models showing the relations between attachment in toddlerhood and academic achievement in adolescence (Model 1) and between effortful control in toddlerhood and academic achievement in adolescence (Model 2). Ellipses indicate latent variables, and rectangles indicate observed variables. Values outside parentheses are unstandardized regression coefficients; values inside parentheses are standard errors. Asterisks indicate significant paths (** $p < .01$, *** $p < .001$). ITBS = Iowa Test of Basic Skills (Hoover, Dunbar, & Frisbie, 2001); ITED = Iowa Test of Educational Development (Feldt, Forsyth, Ansley, & Alnot, 1993); CBCL = Child Behavior Checklist (Achenbach & Rescorla, 2001); CBQ = Child Behavior Questionnaire (Rothbart & Bates, 2006).

predicts achievement in adolescence (Model 2). Each model demonstrated excellent fit—Model 1: $\chi^2(2) = 1.60$, $p = .449$, CFI = 1.00, TLI = 1.00, RMSEA = 0.000, SRMR = .021; Model 2: $\chi^2(4) = 5.66$, $p = .226$, CFI = .987, TLI = .968, RMSEA = 0.044, SRMR = .034.

As shown in Figure 2, the mediational model (Model 3) demonstrated excellent fit, $\chi^2(7) = 7.28$, $p = .400$, CFI = .998, TLI = .996, RMSEA = 0.014, SRMR = .034, and an indirect effect of attachment on achievement via effortful control was present, 95% CI = [0.02, 1.41]. Further, this mediation effect was replicated when we controlled for the age of the child when achievement was assessed, 95% CI = [0.02, 1.41]. Note that attachment was no longer associated with achievement when we controlled for effortful control.

A multiple-group analysis was conducted to determine whether there was invariance in the model across the two aggregated samples (i.e., Sample 1 vs. Sample 2). A model with the paths free to vary between the two groups did not fit the data better than a model with the paths fixed to be equal between the groups, $\chi^2(3) = 3.16$, $p = .368$. Thus, the findings were not shown to vary across samples. Further, a multiple-group analysis revealed that the model did not vary as a function of gender, $\chi^2(3) = 4.59$, $p = .204$.

Discussion

In the present study, effortful control in toddlerhood predicted general academic achievement over a decade

Model 3: Mediation

Fig. 2. Mediation model showing the effect of attachment in toddlerhood on academic achievement in adolescence, as mediated by effortful control in toddlerhood. Values outside parentheses are unstandardized regression coefficients; values inside parentheses are standard errors. Symbols indicate path significance ($^{\dagger}p < .10$, $^{**}p < .01$, $^{***}p < .001$); the dashed line indicates that for this path, p was nonsignificant. ITBS = Iowa Test of Basic Skills (Hoover, Dunbar, & Frisbie, 2001); ITED = Iowa Test of Educational Development (Feldt, Forsyth, Ansley, & Alnot, 1993); CBCL = Child Behavior Checklist (Achenbach & Rescorla, 2001); CBQ = Child Behavior Questionnaire (Rothbart & Bates, 2006).

later. These findings complement extant data regarding positive effects of effortful control on a variety of future outcomes, including socioemotional competencies, adjustment, and achievement shown over shorter time periods (e.g., Kochanska & Kim, 2013; Swanson et al., 2014; Valiente et al., 2011). Our results also build on emerging evidence that the quality of formative relationships in early life predicts positive functional outcomes (e.g., Kochanska, 2001; Spinrad et al., 2007). However, the majority of that work concerns outcomes in the socioemotional domain over shorter periods of time. More recent research suggests that these effects may also extend to achievement (e.g., Bergin & Bergin, 2009; Swanson et al., 2014). Our work is the first to show that early mother-child attachment security triggers a meaningful cascade that significantly explains academic achievement over a decade later through its influence on effortful control.

Implications

This work points to the importance of early parent-child attachment and its role in enhancing skills and capacities that might prove foundational for later success in school and work. Furthermore, our results raise an important question: Can enhancing mother-child

attachment security or effortful control in toddlerhood (or both) meaningfully affect academic success in adolescence? There is some evidence that effortful control skills can be taught (e.g., Diamond, Barnett, Thomas, & Munro, 2007); however, future research needs to ascertain the efficacy of such interventions more fully.

There is broad empirical support for the long-term implications of parental or home-based interventions targeting maternal responsiveness, particularly early in life (Bernier, Carlson, & Whipple, 2010). Research consistent with our results has demonstrated that a secure, supportive, responsive caregiving environment early in life can provide the inner resources that foster such positive characteristics as effortful control (Kochanska & Knaack, 2003). In turn, these early differences may promote better functioning in both the socioemotional (e.g., Swanson et al., 2014; Valiente et al., 2011) and achievement domains as much as a decade later.

Attachment theorists have long suggested that attachment security has implications for emotion and self-regulation (Cassidy, 1994; Sroufe, 2005). Moreover, consistent with the notion of phenotypic plasticity (Hane & Fox, 2006), a growing body of evidence indicates that effortful control can be modulated by factors that pertain to the quality of the attachment relationship (Kochanska, 2001) and should not be viewed as a fixed

trait (Rothbart & Sheese, 2007). Infancy and toddlerhood also appear to be a period of development during which exposure to adverse family conditions may have the greatest effect on neurobiological and physiological systems (Davies & Sturge-Apple, 2007). Our results indicate that a social factor (parent-child relationship) in toddlerhood affects a child temperamental factor, that, in turn, has an influence on achievement much later in development. Indeed, it seems critical to investigate directly whether interventions that enhance security of mother-child attachment during this heightened time of susceptibility have direct and indirect positive effects on academic outcomes. For example, given that insensitive parents increase the risk of insecure attachment in offspring, such parents may benefit from efforts to prevent maladaptive developmental cascades characterized in part by poor effortful control that may ultimately lead to deleterious outcomes later in life. Several recent studies have found that toddlers and preschool-age children of parents involved in attachment-based interventions exhibit improved effortful control (e.g., Cassidy et al., 2017; Lind, Raby, Caron, Roben, & Dozier, 2017). An important next step would involve examining the impact of improved effortful control on later achievement-based outcomes.

Limitations

The children in this study came from a relatively well-functioning population lacking racial diversity. Although it is difficult to predict how well these findings would generalize to samples of children at higher risk, the magnitude of these associations could be larger for children growing up in contexts characterized by greater adversity (Evans, 2004). An important future step will be to conduct similar studies in children from high-risk backgrounds, who are more likely to experience detrimental living conditions and lack of access to high-quality education. A strength of our work is its longitudinal design, although we cannot establish causation. Further, for some participants (Sample 1), mother-child attachment security and effortful control were assessed concurrently. In contrast, for participants in the second sample, attachment security was assessed approximately 10 months before effortful control. The model's paths (including the path from attachment to effortful control) were invariant across studies. Thus, the directional path was significant when attachment temporally preceded effortful control, a finding that is consistent with emerging evidence showing that parental behavior fosters children's effortful control during preschool years (Lind et al., 2017). Nonetheless, the results do not rule out alternative pathways of reciprocal causation. Finally, future studies should assess

whether the current results replicate using the Strange Situation procedure, a preferred measure of infant attachment security.

Conclusion

It is striking that noncognitive factors, such as social-affective and family factors early in development, predict a societally valued achievement outcome more than a decade later. Important future directions include examining additional mechanisms and possible moderators of this developmental cascade from a mother-child relationship to a within-child self-regulatory variable to an achievement outcome. For example, what effects do fathers and other caregivers (e.g., teachers) have on this developmental cascade? Could a secure attachment with other important figures help compensate for insecure mother-child attachment in the development of effortful control? Do other within-child variables, including other temperamental traits, serve as protective or risk factors for this cascade? These and other questions can help us further understand the complex and varied paths ultimately leading to academic success.

Action Editor

Ralph Adolphs served as action editor for this article.

Author Contributions

L. Dindo developed the study concept and collected the data at follow-up during adolescence. G. Kochanska collected and analyzed the early childhood data. All the authors contributed to the study design. Data analyses were performed by R. L. Brock and N. Aksan. L. Dindo drafted the manuscript, and L. A. Clark, R. L. Brock, W. Gamez, and N. Aksan provided critical revisions. All the authors approved the final version of the manuscript for submission. L. Dindo and R. L. Brock contributed equally to this work.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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