Predicting Academic Competence in Elementary School from Children's

Early Temperamental Approach Reactivity and Effortful Control

by

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A Thesis Presented in Partial Fulfillment
of the Requirements for the Degree
Master of Arts

Approved October 2014 by the
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ARIZONA STATE UNIVERSITY

December 2014

ABSTRACT

Researchers who have previously explored the relation of broad-based temperamental approach constructs, such as surgency/extraversion, exuberance, or behavioral approach sensitivity, to academic competence (AC) in early elementary school have often found conflicting results. Moreover, few researchers have examined the interaction between these approach reactivity constructs and effortful control (EC) in the prediction of AC. The goal of the current study was to examine the fine-tuned relations of different aspects of temperamental approach reactivity in early childhood (42 and 54 months; N=223), such as impulsivity, frustration, and positive affect, as well as EC, to AC during early elementary school (72 and 84 months). Examining the complex relations may clarify the literature using broad-based approach reactivity constructs. Temperament was observed in the laboratory when children were 54 months of age. Mothers and caregivers also reported on children's impulsivity at 42 and 54 months. School-related behavioral adjustment was reported by children, mothers, and teachers, and GPA was reported by teachers at 72 and 84 months. The results of the study indicated that positive affect, EC, and receptive language ability were the only unique direct predictors of school adjustment and/or GPA. Without EC in the model, only positive affect and vocabulary predicted AC. Frustration, positive affect, and impulsivity each interacted with EC to predict AC outcomes, such EC was only related to higher AC for children with high impulsivity or anger, or low positive affect. Additionally, positive affect and impulsivity interacted to predict GPA, such that impulsivity was positively related to GPA for children with high positive affect, but it was negatively, albeit nonsignificantly, associated with GPA for children with low positive affect. These results were found to be similar for boys and girls. Finding are discussed in terms of the developmental importance of early EC for academic competence for children who have high approach reactivity, as well as the interactive effects of dimensions of approach reactivity on academic achievement.

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CHAPTER 1

INTRODUCTION

Large numbers of young children in the U.S. struggle with basic social and academic competencies, despite the importance of these skills for later academic, health, and financial status (U.S. Department of Education, 2004; Duncan et al., 2007). In one study, about 33% of kindergarten teachers reported that over 50% of their class entered kindergarten with social and behavioral problems (Rimm-Kaufman, Pianta, & Cox, 2000). Moreover, children enrolled in preschool classrooms characterized by greater disruptive behavior were more likely to be rated by their teachers as more aggressive and disruptive than their classmates in second grade (Howes, 2000), indicating that children's competencies may be impacted early on by disruptive behavior in the classroom. A large body of research also indicates that children's social competence in early elementary school has an impact on their concurrent and later academic competence (Ladd, Birch, & Buhs, 1999; Denham & Brown, 2010), and many scholars posit that academic and social competence bidirectionally influence each other as children develop (Teglasi, 2010; Véronneau, Vitaro, Brendgen, Dishion, & Tremblay, 2010; Welsh, Parke, Widaman, & O'Neil, 2001). Despite the importance of understanding the predictors of both academic achievement and social-emotional adjustment to school, little work has been done to examine the factors prior to school entry that are associated with both of these constructs in early elementary school.

Academic competence (AC) is broadly defined as classroom adjustment, including the teacher's view of children's classroom learning behavior and children's feelings about school, as well as measures of academic achievement, such as GPA. An important aspect of school adjustment in particular is social competence (SC), defined as adaptive peer relationship skills, such as conflict management, cooperation, sharing, sympathy, and prosocial behavior, as well as peer likability (Ladd, 2005). SC might contribute more to AC outcomes related to school adjustment, rather than academic achievement, because interpersonal skills are an integral part

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of social behavior in the classroom. Because aspects of temperament have been associated with both AC and closely-related components of SC (peer relationships in particular), understanding how temperament impacts the development of these competencies is likely a prerequisite for tailoring effective school-based social-emotional learning programs for temperamentally at-risk children (Jones & Bouffard, 2012).

Temperament has been defined as "constitutionally based individual differences in reactivity and self-regulation in the domains of affect, activity, and attention" (Rothbart & Bates, 2006, p. 100), where reactivity is defined as "responsiveness to change in the external and internal environment" and self-regulation is defined as "processes such as effortful control and orienting that function to modulate reactivity" (p. 100). Temperament researchers also emphasize the importance of understanding the interactions between temperamental reactivity and self-regulation in order to gain a more comprehensive understanding of how these constructs relate to children's adjustment (Rothbart & Bates, 2006).

Most of the work relating temperament to AC or SC has implicated effortful control (EC) as a strong positive predictor in early childhood (for reviews, see Blair, Calkins, & Kopp, 2010 and Eisenberg, Hofer, Sulik, & Spinrad, 2014). EC is defined as "the efficiency of executive attention, including the ability to inhibit a dominant response and/or to activate a subdominant response, to plan, and to detect errors" (Rothbart & Bates, 2006, p. 129). In addition to EC, researchers have also shown that aspects of temperamental reactivity that involve motivation to approach and interact with the environment, such as anger/frustration, high intensity positive affect, and impulsivity, are often risk factors for disruptive behavior problems in early childhood (Martel, Gremillion, & Roberts, 2012; Eisenberg et al., 2009; Eisenberg et al., 2004). Moreover, improvements in disruptive behavior problems over time have been associated with changes in aspects of approach reactivity, such as anger and impulsivity (Eisenberg et al., 2005), highlighting the importance of tailoring interventions and preventions toward adjusting approach-related temperamental trajectories.

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For these reasons, examining multiple aspects of the relations between temperamental approach reactivity and EC to AC could inform effective school-based social-emotional learning programs designed to enhance children's academic and social success. These programs could not only directly improve AC for temperamentally at-risk children, but also indirectly improve children's academic attainment in the U.S. school systems through reduction of global disruptive behavior problems in classrooms. Despite fine-tuned associations between approach reactivity and EC to AC mentioned in the literature, few researchers have included all of these constructs in the same model, which is an important limitation considering they are often correlated with each other (Rothbart & Bates, 2006). If the dimensions of approach reactivity are at most modestly correlated, including them in the same model will clarify how each of the dimensions uniquely contributes to AC. On the other hand, controlling for the correlations between these constructs does not enable us to interpret how the shared variance among the dimensions of approach reactivity relate to AC; this question has been addressed in the literature on broad-based approach reactivity constructs and is not be analyzed in this study.

In addition, few researchers have examined the interactions among EC and dimensions of approach reactivity when predicting AC, and few researchers have measured these constructs using multiple indicators to capture shared variance across measurement approaches. The goal of the current multi-method study was to examine the fine-tuned relations of temperamental approach reactivity (i.e., frustration, positive affect, and impulsivity) and EC prior to elementary school to AC in first and second grade; the longitudinal nature of this study may provide insight into how temperament in early childhood relates to AC after entry into formal schooling. In addition, the current study examined the interactions between each dimension of approach reactivity and EC, as well as interactions among dimensions of approach reactivity. These interaction effects may clarify the findings of studies involving the relation of these constructs to AC.

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Relations of EC to AC

There is a large, robust body of literature suggesting positive effects of EC on SC-related outcomes (for reviews, see Eisenberg, Eggum, Sallquist, & Edwards, 2010 and Eisenberg et al, 2013). Given the role of social behavior in adaptation to the school context, findings relevant to SC can provide hints regarding the potential role of EC on AC. In regard to SC, Lengua (2003) found that teachers' reports and self-reports of 3rd through 5th grade children's inhibitory control were positively related to self and mothers' reports of SC. Lengua also found that children who had difficulty waiting during a delay of gratification task at the laboratory assessment were rated by teachers as lower in SC, both concurrently and at a follow-up assessment one year later. Dennis, Brotman, Huang, and Gouley (2007) found that two statistically distinct subcomponents of EC observed in the laboratory, suppress/initiate and motor control, both positively predicted parent-rated SC in a sample of 4-6 year olds at-risk for problem behaviors in separate models with each EC subcomponent as a predictor. Similarly, after controlling for child and teacher demographic variables, preschoolers' EC as reported by parents was associated with teachers' reports of fewer conduct problems and higher prosocial behaviors but was unrelated to teachers' reports of peer or emotional problems (Ponitz, McClelland, Matthews, & Morrison, 2009). These results suggest that EC is a robust predictor of SC in young elementary school-aged children across a variety of measurement strategies.

EC assessed with multiple methodologies has also consistently been related to AC (for a review, see Eisenberg, Valiente, & Eggum, 2010). For example, preschool children with higher EC at the beginning of the school year, measured with parents' reports and behavioral tasks, were more likely to have a positive student-teacher relationship as reported by teachers in the middle of the year, which in turn predicted children's and teachers' reports of positive attitudes toward school at the end of the year (Silva et al., 2011). In a review of the theoretical literature, Blair, Calkins, and Kopp (2010) suggested that each of the components of self-regulation, such as emotion-related regulation, EC, and executive function, contribute uniquely to academic

outcomes. Similarly, Eisenberg and colleagues (2014) suggest that EC and executive functioning are overlapping yet somewhat distinct constructs that assist in children's emotion-related self-regulation, which is related to AC and SC.   Corroborating this, Checa, Rosario, and Rueda (2011) found that, after controlling for IQ, 12-year-old children's performance on executive function tasks and parents' reports of EC, when entered into the same model, were both positively related to children's grades in school and their self-reported AC. However, because EC and executive functioning were assessed with different methodologies, it is impossible to rule out that this independent prediction was due to methods effects. In sum, EC measured in multiple ways has also been a consistent predictor of positive AC, even after controlling for highly related constructs such as executive function.

Relations of Broad-Based Approach Reactivity Constructs to AC

Researchers have often defined temperamental approach reactivity in terms of clusters of relatively involuntary motivational traits that drive an individual to approach and interact with his or her environment. The three approach reactivity constructs most commonly noted in the literature are extraversion/surgency (Rothbart, Ahadi, Hershey, & Fisher, 2001), Behavioral Activation/Facilitation System sensitivity (BAS; Gray, 1970; Depue & Collins, 1999), and exuberance (Putnam & Stifter, 2005). Although much work has examined the association of these approach reactivity constructs to AC-related outcomes, the direction of findings has not always been consistent across studies.

Direct effects. Temperamental extraversion/surgency in children is often comprised of impulsivity, high intensity pleasure, activity level, and shyness reversed. Positive affect, smiling/laughter, and anger/frustration also tend to have positive secondary loadings on this construct (Rothbart et al., 2001). However, many scholars define extraversion as higher in aspects of sociability as well, which makes this construct different from Rothbart's extraversion surgency construct (McCrae & Costa, 1987). Hawley (2002) found that children whose mothers rated them higher on surgency were more likely to be classified as dominant in observed peer

interactions; these children used both prosocial and coercive strategies more than their non-dominant peers, but they tended to use the latter nearly twice as often as the former, indicating that there may be individual differences in the way surgent children interact with their peers. Supporting this notion, researchers have found that, on one hand, ratings of extraversion, defined with emphasis on sociability, have been related to higher rank-order and steeper positive slopes in SC across preschool and elementary school years (Kavčič, Podlesek, & Zupančič, 2012). On the other hand, surgency, measured with Rothbart's Child Behavior Questionnaire (CBQ) has also been related to higher reported aggression and externalizing problems in childhood, behaviors typically associated with lower SC (Honomichl & Donnelan, 2012; Berdan, Keane, & Calkins, 2008). Similarly, for measures of academic achievement, associations with extraversion are mixed. However, in a recent meta-analysis, Poropat (2009) found that extraversion, defined with an emphasis on sociability, was positively related to achievement, and this association was only significant in primary, rather than secondary or tertiary, school, indicating that it may be more important to examine the possible role of surgent positive affect on AC in younger children. Notably, extraversion does not always incorporate surgency in its definition, so findings with extraversion may not always reflect these broad-based approach reactivity constructs.

BAS sensitivity is another approach reactivity construct in the literature that refers to a motivational system underlying personality which organizes behavior in response to appetitive stimuli. Individuals high in BAS motivation are sensitive to stimuli that signal reward or relief from punishment. (Gray, 1970; Depue & Collins, 1999). Similar to the construct of extraversion, individuals high in BAS sensitivity are more likely to experience frequent and intense positive affect, frustration, and impulsivity, particularly in contexts involving rewarding appetitive stimuli (Bijttebier, Beck, Claes, & Vandereycken, 2009). BAS and extraversion are also typically positively correlated in children (Blair, 2003; Slobodskaya, 2007). Similar to extraversion, BAS is also positively related to ratings of aggression and conduct problems in children (Muris, 2005). However, Blair (2003) found that BAS sensitivity did not predict teachers' reports of children's SC

or on-task classroom behavior.   In contrast, Slobodskaya (2007) found that, above and beyond the effects of extraversion, BAS sensitivity was positively related to academic achievement and negatively related to self-reported prosocial behavior in adolescents. Thus, although they are conceptually similar to each other, it is unclear whether extraversion/surgency and BAS sensitivity are overlapping constructs in childhood but diverge in adolescence (given that BAS has not been studied independent of extraversion in relation to achievement), or whether BAS and extraversion/surgency relate to social and academic outcomes in similar ways throughout development.

Finally, exuberance is considered a temperamental approach reactivity construct, and it is defined as positive reactivity to novelty, approach behavior, and sociability (Degnan, Hane, Henderson, Moas, Reeb-Sutherland, & Fox, 2011). Exuberance has been associated with impulsivity, sensitivity to reward, fearlessness, and risk taking in childhood (Polak-Toste & Gunnar, 2006; Putnam & Stifter 2005). Extraversion/surgency and exuberance are positively correlated in children (Polak-Toste & Gunnar, 2006; Degnan et al., 2011). Similar to extraversion, inter-individual stability in exuberance appears early in childhood (Pfeifer, Goldsmith, Davidson, & Rickman, 2002; Fox, Henderson, Rubin, Calkins, & Schmidt, 2001). Similar to BAS sensitivity, children high in exuberance tend to express more positive affect in response to novel and rewarding stimuli and more anger/frustration when rewards are blocked (Polak-Toste & Gunnar, 2006; Putnam & Stifter, 2005; Hane, Fox, Henderson, & Marshall, 2008).

Exuberance has been inconsistently related to socially competent behaviors with peers. For example, Tarullo, Milner, and Gunnar (2011) found that in comparison to inhibited children, moderately or highly exuberant children were rated as having greater social dominance and peer impact; they were observed to be more socially integrated and to have closer friendships, but they also had more conflict with peers and expressed more intense/frequent angry mood. Similarly, Dennis, Hong, and Soloman (2010) found that exuberant preschoolers were rated by mothers as having greater social skills and were observed to be better regulated on a

disappointing gift task, but they were also rated higher in externalizing problems, emotion dysregulation, and emotional lability by mothers. These results suggest that, similar to children high in surgency/extraversion and BAS sensitivity, exuberance can be related to positive and negative peer relationships, and more information is needed to specify the pathways between exuberance and SC. To my knowledge, exuberance has not yet been studied in association with academic outcomes.

Interaction with EC. Following the suggestion of Rothbart (2006), researchers have occasionally examined how extraversion/surgency, BAS sensitivity, or exuberance interacts with self-regulation to predict AC. Regarding surgency/extraversion, limited evidence suggests that surgency and EC do interact, but the direction is not always consistent. For example, Dollar and Stifter (2012) found that 4.5 year-old surgent children who exhibited more social support-seeking behaviors (which can be viewed as a type of coping or self-regulation) during a goal blockade paradigm were rated by mothers as less aggressive than surgent children who used less social support seeking. On the other hand, if surgent children distracted themselves from the desirable object or used self-soothing behaviors (also considered methods of self-regulation), they were rated by mothers as lower in parent-reported SC (social skills and peer acceptance) than if they did not use these behaviors. This study suggests that regulation strategies that allow young children to approach and interact with the desired goal constructively are associated with fewer negative social outcomes for surgent children, but regulation strategies that suppress surgent children's motivation toward desirable objects are associated with poorer social outcomes. Gunnar, Sebanc, and Tout (2003) found that surgent preschoolers with poorer reported EC experienced more peer rejection because they tended to be rated by teachers as more aggressive, indicating that the combination of high surgency and low EC could be a risk factor for peer relations.

The differences in findings across studies could be for several reasons. As is discussed later, it could be because some characteristics of surgency, such as positive affect or impulsivity,

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may be valued in peer relationships during early elementary school, whereas other aspects are less valued. In addition, these findings may reflect differences in measurement of surgency or regulation (observed in goal-blockade context vs. temperamental reports; extraversion defined as surgency or as surgency and sociability), as well as the utilization of fairly diverse peer constructs as outcome variables, such as victimization, SC, and aggression.

In regard to academic achievement and surgency, Deater-Deckard, Mullineaux, Petrill, and Thompson (2009) found that parents' reports of 7-year-olds' EC was positively related to reading performance only when their parents also rated them low in surgency, suggesting that EC was only advantageous for AC when children were not rated as surgent. More work is needed to replicate this pattern of results with achievement.

Exuberance has also been found to interact with EC to predict social outcomes. Relevant studies suggest that exuberance is usually related to positive outcomes unless children have poorer regulation skills. Rydell, Berline, and Bohlin (2003) found that proneness to exuberant positive emotions or regulation of those exuberant emotions uniquely and positively predicted mothers' reports of prosocial behavior in middle childhood. Additionally, they found an interaction between exuberance and regulation, such that that exuberance was positively related to parents' and teachers' reports of externalizing behavior only when regulation of exuberance was low. Similarly, Stifter, Putnam, and Jahromi (2008) found that two-year-olds who were behaviorally classified as exuberant were more likely to be rated by their mothers as high in total problem behaviors only if they displayed lower self-regulation during a disappointing gift paradigm. Using both reported and observed measures of exuberance, Dennis and colleagues (2010) found that exuberant children were reported by mothers to have more emotion regulation problems only if they were also low in EC; however, regardless of EC, all exuberant children exhibited more regulatory behavior during a disappointing gift paradigm relative to less exuberant children. These results suggest that exuberant children may be at risk for poorer social outcomes at school when they are unable to efficiently regulate their own approach reactivity.

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Overall, the results from the literature examining the relations between broad-based approach reactivity constructs and AC-related outcomes have been mixed. This may have occurred for several reasons. First, it is possible that these broad-based constructs are too broad; they capture too many dimensions of trait approach reactivity which may or may not always cohere together. For example, impulsivity may have a positive main effect on AC when EC is also entered in the model (e.g. Valiente et al., 2013; Eisenberg et al., 2004), but there may be different patterns of interactions between impulsivity and other dimensions of emotional approach reactivity, such as positive affect or frustration, when predicting AC. For example, children with both high dispositional impulsivity and anger may exhibit adjustment problems (Eisenberg et al., 2004). Thus, it is important to consider not only how EC interacts with each dimension of approach reactivity, but also how dimensions of approach reactivity interact with each other.

Fine-Tuned Associations of Approach Reactivity to AC

  Impulsivity. Impulsivity, often referred to as reactive undercontrol (RUC), has been defined as approach behavior without much thought, often assessed by the speed of response initiation (Eisenberg et al., 2013). RUC is a separate construct from EC because it is thought to be a relatively involuntary and difficult-to-control motivational response rather than a volitional-if-necessary trait like EC. Additionally, RUC becomes a separate construct from behavioral inhibition, or reactive overcontrol, between 30 and 42 months of age (Eisenberg et al., 2013), so low behavioral inhibition and high impulsivity are conceptually and statistically different from each other by at least 42 and 54 months of age.

  Direct relations. Studies that consider the relations of impulsivity to AC outcomes have consistently found negative relations. For example, impulsivity was associated with lower academic enablers, like engagement, interpersonal skills, motivation, and study skills, which in turn predicted academic achievement (Demaray & Jenkins, 2011). Similarly, preschool teachers' ratings of impulsivity were also associated with lower letter knowledge assessment scores, even

after controlling for teachers' ratings of temperamental inhibition (Wagner Fuhs, Wyant, & Day, 2011). In addition, impulsivity observed in the laboratory has been positively associated with teachers' reports of fourth-grade children's learning difficulties (Glenwick, 1976). Together, these results suggest that impulsivity across multiple measurement methodologies is negatively associated with AC when EC is not simultaneously considered in the model.

In addition to predicting academic achievement, impulsivity has also been negatively associated with SC-related outcomes. For example, fourth-grade children who made more errors on the Matching Familiar Figures test, a well-known assessment of cognitive impulsivity, were more likely to be rated by teachers as higher in moodiness and acting out behavior, and they were less likely to be nominated by their peers as desirable to play with (Glenwick, 1976). Using a cohort-sequential design, Dempsey, Fireman, and Wang (2006) found that girls in 3rd, 4th, or 5th grade who were consistently victimized over a one-year period were more likely than girls who transitioned out of victimization status during that year to be nominated by their peers as highly impulsive.

Despite the fact that impulsivity is typically associated with a variety of lower AC outcomes, some researchers find that impulsivity is positively associated with peer ratings of likability in kindergarten (Gomes & Livesey, 2008; Gleason, Gower, Hohmann, & Gleason, 2005). It is possible that moderate levels of impulsivity are associated with a desirable level of spontaneity in peer interactions for young children, but low or high levels of impulsivity are negatively related to peer-rated likability and resiliency (Eisenberg, Spinrad, & Morris, 2002). It is also possible that impulsivity is positively related to outcomes related to school adjustment, rather than academic achievement, for younger but not older elementary school-aged children.

Because RUC and EC tend to be negatively related, a more stringent test of the association between RUC and AC is to simultaneously include EC in the model as a predictor of AC. This approach rules out the potential confounding effect of EC by examining the unique prediction of each of these temperamental constructs to AC outcomes. There is little evidence

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that RUC is directly related to AC above and beyond the effects of EC, although it has been indirectly associated with lower internalizing problems through higher resiliency when EC was included in the model (Eisenberg et al., 2004). In a study examining direct relations of impulsivity to social skills, teachers' and self-reports of elementary school-aged children's impulsivity were not associated with SC after controlling for other emotionality and regulation variables (Lengua, 2003). However, Spinrad and colleagues (2006) found that, after controlling for EC, children at risk for behavior problems who were rated by adults as more impulsive at age six were less likely than their peers to be rated by adults as popular two years later; in addition, children who had been rated more popular at age six were more likely to be rated by adults as impulsive two years later. These results suggest that popularity and impulsivity may have unique bidirectional relations over time, and early impulsivity may be a risk factor of later peer relation problems, independent of the effect of EC on these outcomes.

More work needs to be done in this area to clarify whether these relations exist regarding impulsivity and school adjustment or academic achievement, specifically. In a study by Valiente and colleagues (2013), reported measures of impulsivity and EC uniquely and positively predicted academic achievement when children were between the ages of four and eight, but impulsivity did not uniquely predict achievement six years later; nor did it longitudinally predict achievement with EC in the model. Moreover, this study found quadratic associations between impulsivity and achievement at the first but not second time-point. When EC was not included in the model, low and moderate impulsivity were associated with higher achievement than high impulsivity; when EC was included in the model, low impulsivity was associated with lower achievement than moderate or high impulsivity. These findings highlight the importance of examining quadratic relations between impulsivity and AC in younger children, at a more specific age range, and including EC in the model when assessing both direct and curvilinear associations.

Interaction with EC. Although RUC sometimes may not explain unique variance in AC beyond that which is explained by EC, particularly for older children, there has been evidence that

EC may interact with RUC to predict AC with younger children. In a study by Valiente and colleagues (2012), observed and reported measures of RUC were differentially moderated by EC. Observed impulsivity on a computer task was negatively related to classroom participation and the quality of the student-teacher relationship, but only when children's observed or reported EC was low or moderate. Reported impulsivity, however, was positively related to the student-teacher relationship (high closeness and low conflict) for children with high levels of reported EC. In another study, reports of impulsivity and EC did not interact to predict academic achievement (Valiente et al., 2013). In sum, it is unclear how EC will interact with a latent construct of RUC that includes observations of impulsivity in different contexts and impulsivity reported by adults.

Few researchers have examined how RUC interacts with emotional approach-reactivity variables such as positive affect and frustration to predict AC. Eisenberg and colleagues (2004) found that impulsivity was positively related to externalizing problems regardless of children's dispositional anger; however, this relation became stronger as teachers' reports of children's dispositional anger increased. It is unclear if observed frustration, which specifically reflects frustration in response to blocked goals, interacts with impulsivity in a similar matter, because teachers' reports of anger likely reflect both frustration-related reactions within the classroom (often in response to difficulty with tasks) as well as anger expressed in peer context, which is likely more associated with deleterious outcomes than task-related frustration.

Positive affect. Theory regarding positive emotionality suggests that the function of all positive emotions is to facilitate approach behavior and continued action (Frederickson & Kohn, 2010; Putnam, 2012). Despite this shared function, positive emotions expressed in various contexts may differentially relate to AC outcomes (Depue, 2012).

Direct relations. Research examining the relation between positive affect and AC has yielded consistent results. When positive emotions are expressed in affiliative contexts, they are typically associated with better AC. For example, observed positive affect during preschoolers' free play was associated with less observed reticent play behavior at the beginning and the end

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of the school year, and greater decreases in reticent play over the course of the year (Spinrad et al., 2004) Also among preschool children, observed positive affect during dyadic play sessions with peers predicted more observed initiated positive interactions within the classroom, more positive peer nominations, and higher teacher-rated classroom adjustment (Shin et al., 2011). Similarly, early elementary school children's positive affect observed during recess was positively associated with teachers' ratings of SC (Jones, Eisenberg, Fabes, & MacKinnon, 2002). Preschoolers' observed positive affect in the classroom was also positively related to the number of likability ratings from peers (Denham McKinley, Couchoud, & Holt, 1990).

Although much work has been done exploring the relations between positive affect and school adjustment-related outcomes, there is little research examining positive affect in relation to academic achievement. Positive affect is thought to broaden behavioral and attentional repertoires to include more novel thinking, relationships, and activities, which in turn builds personal resources such as social support, resilience, skills, and knowledge (Frederickson & Cohn, 2010). This suggests that positive affect should relate to higher achievement. Supporting this, a study with infants suggests that 6-month-old infants who expressed higher levels of positive emotion, relative to infants who expressed less positive emotion, were more likely to have higher scores on a mental development index when they were two years old (Robinson & Acevedo, 2001). Positive affect in that study was averaged across six emotionally challenging situations so it is impossible to delineate the potential influence of situational context of positive affect from these results.

Although there is much work that associates positive affect expressed in affiliative context with AC, there is virtually no work that examines the correlates of positive affect expressed in contexts involving desirable or rewarding stimuli; it is possible that displays of positive affect in these situations relates differently to AC than positive affect in affiliative contexts. Given that positive affect expressed in contexts involving rewarding stimuli is the main component of positive affect implicated in definitions of approach reactivity constructs (BAS and exuberance in

particular), this study adds to the current literature by examining the relations between positive affect in this context and AC.

Nonlinear relations. In addition to context, another potential factor to consider in the relation between positive emotion and AC is intensity. A review of the adult literature on positive affect (Gable & Harmon-Jones, 2010) suggests that high-intensity positive affect results in narrowing of attention to focus on elements in the environment, while low-intensity positive emotions result in broadening of cognitive processing to a more global level. Supporting this, a meta-analysis that included work with adults suggested that moderate levels of positive emotion were related to more helping behavior than either high or low degrees of positive affect (Carlson, Charlin, & Miller, 1988). Thus, high-intensity positive affect could be associated with poorer performance at school because of the narrowing effect it has on cognition and memory.

In a theoretical piece, Valiente, Swanson, and Eisenberg (2012) suggest that quadratic associations between positive affect and AC may also exist, whereby high intensity positive affect is negatively related to AC but low and average intensity positive affect are associated with higher AC. Supporting this notion, Eisenberg and colleagues (1996) found that teachers' and parents' reports of positive emotional intensity were positively associated with fathers' and teachers' reports of problem behaviors in kindergarten, which suggests that positive emotional intensity may also be related to poorer AC outcomes, but more work in this area is needed. This hypothesis also is consistent with findings that high intensity observed positive affect was associated with lower EC in early childhood (Kochanska, Murray, & Harlan, 2000), and that high intensity reported positive affect has been associated with steeper declines in reported SC over time in elementary school-aged children (Sallquist et al., 2009). Together, this work suggests that positive affect could be related to higher AC when positive affect is low or moderate, but high intensity positive affect may be associated with lower AC.

Finally, it could also be the case that the effect of positive emotion on AC interacts with EC and/or impulsivity to predict AC. Rydell, Berlin, and Bohlin (2003) found that 5- and 6-year-

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old children's ability to regulate exuberant positive emotion was negatively related to problem behaviors only for children with high exuberant positive affect. Although the outcomes in that study were related to social and emotional adjustment, it is possible that this pattern of results could be found in relation to AC outcomes as well, particularly school adjustment outcomes. Children with high levels of positive affect may rely more on regulation in order to respond appropriately in school-related contexts; whereas, EC may not matter as much for children's AC when children experience low or average levels of positive affect. Moreover, children with low or average impulsivity may experience better AC, regardless of positive affect; whereas children with high impulsivity may experience different AC outcomes, depending on their level of exuberant positive affect. The interaction between positive affect and impulsivity has not been tested in previous work.

Frustration. Children rated higher in exuberance or BAS sensitivity are also more likely to express frustration when desirable rewards are blocked or delayed. Anger is considered an approach-oriented emotion because it motivates the individual to interact with the environment in order to overcome the obstacle or delay in obtaining a desirable reward (Carver & Harmon-Jones, 2009). Thus, when considering the correlates of anger, it is important to consider the context in which anger/frustration is measured in order to understand the relation of approach-oriented anger reactions to AC.

Clarifying anger measurement. Researchers examining the relations between anger and AC have found fairly consistent evidence that unregulated anger is detrimental for these outcomes. However, temperamental questionnaire measures of anger/frustration, which these findings are primarily based on, typically encompass three closely-related anger constructs: frustration, defined as negative affect arising when access to goals, resources, or desirable objects are perceived to be blocked; anger, defined as negative affect that signals retaliatory or reward-seeking behavior; and irritability, defined as aversive sensations in response to stimulation that can precede or follow angry episodes (Deater-Deckard & Wang, 2012). Whereas

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anger and irritability, particularly when expressed in peer contexts, may be directly and indirectly associated with poorer AC outcomes, it is unclear how frustration expressed specifically in the context of blocked goals or rewards is associated with these outcomes. For example, three- to five-year-old Chinese children's observed anger during tasks where a desirable goal was blocked was positively associated with persistence during that task. In contrast, children's observed anger during a tedious task not involving a reward was not correlated with persistence on the task (He, Xu, & Degnan, 2012). In another study comparing the correlates of dispositional anger and anger expressed in goal-blockade contexts, teachers' reports of children's irritability negatively predicted SC concurrently and one year later in 3rd through 5th grade children, even after controlling for other emotionality and regulation variables. In contrast, children's observed frustration while completing a difficult puzzle with an experimenter who was acting unfairly was unrelated to SC (Lengua, 2003). These results suggest that when anger is expressed in contexts involving desirable goals or rewards, it may not be directly detrimental to children's outcomes. Instead, a more complicated relation may emerge whereby anger expressed in goal-blockade contexts interacts with EC or impulsivity to predict AC. Because the broad-based constructs of temperamental approach reactivity often specify anger reactions particularly in the context of rewards/desirable stimuli (e.g. BAS and exuberance), the current study examines frustration expressed specifically in contexts involving blocked rewards or goals in relation to AC.

Direct relations. Unlike positive affect, both observed and reported measures of frustration have consistently been negatively related to AC. Anger is particularly disruptive in peer contexts during elementary school, when comparing one's self to peers becomes increasingly important for developing self-concept and peer acceptance (Lemerise & Dodge, 2010). For example, anger observed during recess was negatively associated with teachers' ratings of SC for early elementary school-aged boys (Jones et al, 2002). Although their findings were complex, Hanish and colleagues (2004) found that girls and boys had different pathways from anger to peer victimization. Within each semester in kindergarten, teachers' reports,

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mothers' reports, and observed measures of anger positively related to concurrent teachers' reports of victimization, but the mediating pathways were different between genders. Similarly, another study found that although teachers' ratings of attentional control was negatively related to constructive anger reactions for early elementary school-aged boys only, teachers' ratings of anger intensity and emotional intensity were negatively related to constructive anger reactions for both boys and girls (Eisenberg, Fabes, Nyman, Bernzweig, & Pineulas, 1994). These results suggest that although anger is a risk factor for both boys' and girls' developing SC, it is associated with poorer social outcomes through different pathways. Regardless of gender, anger-prone children tend to experience adverse peer relationships, school adjustment problems, and externalizing problems (Lemerise & Harper, 2010).

Anger has also been directly and indirectly related to poorer academic achievement. In a sample of Chinese school children, the relation of teachers' and mothers' reports of children's anger/frustration in early elementary school to children's standardized test performance two years later was significantly mediated by mothers' and teachers' reports of SC, such that earlier anger/frustration was negatively related to later SC, which in turn predicted lower performance on standardized tests (Zhou, Main, & Wang, 2010). In work with undergraduates, Pekrun (2009) found that self-reported anger was negatively related to academic performance, and anger mediated the relation between performance avoidance goals or mastery goals and poorer performance. It is important to note that all of these studies utilized either anger measured by questionnaires or observed in peer/school (i.e. relational) contexts. It is entirely possible that anger expressed in context of goal-blockade may not always be a risk factor for AC.

Interaction with EC or RUC. The relation between anger and AC has also been found to be moderated by EC or impulsivity. Mothers' reports of preschoolers' anger were only associated with teachers' reports of prosocial behavior and externalizing problems in the expected directions if mothers also rated their children low on self-regulation, a composite reflecting both inhibitory control and impulsivity (Diener & Kim, 2004). In another sample of children ranging from four to

eight years old, reported EC was negatively related to externalizing problems at all levels of teachers' reported anger, but this relation became stronger as anger increased (Eisenberg et al., 2004). Interestingly, this study also found the same moderation pattern between anger and impulsivity, suggesting that more researchers should examine the interaction between anger and impulsivity as well.

Anger has also been found to interact with EC to predict academic achievement. Valiente and colleagues (2012) found that adults' reports of kindergartener's anger were only negatively associated with classroom participation and the student-teacher relationship when EC, measured with behavioral tasks and reports, was low or moderate. Similarly, these researchers found that kindergarteners who were reported to be anger-prone were less likely to perform well on math tests only if they were high in EC, suggesting that EC was advantageous for math achievement only if children weren't prone to anger (Valiente et al., 2010). The results from these studies suggest that, while anger is typically negatively related to achievement, it is possible that EC can be advantageous for anger-prone children in relation to classroom learning behaviors like participation or building relationships with the teacher, but it may not confer an advantage in terms of academic achievement.

In contrast to results indicating that EC and anger interact to predict AC, this moderated pattern has also not been found in some studies. For example, in a sample of children followed from five to eight years of age, mothers' ratings of anger were negatively related to mothers', preschool teachers', and first grade teachers' ratings of prosocial behavior and positively related to all three reporters' ratings of externalizing behavior, regardless of anger-regulation ability (Rydell et al., 2003). Thus, it is unclear if anger reports from earlier childhood interact with EC to predict later AC differently than concurrent measures of anger and EC.

Covariates

When considering the relation of temperament variables to AC, several covariates must also be considered in the analyses. Measures of early socioeconomic status (SES) and receptive

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language ability are important variables that influence academic achievement (Gut, Reimann, & Grob, 2013; Justice, Bowles, Pence Turnbull, & Skibbe, 2009; Kurdek & Sinclair, 2001) and school adjustment-related variables (Lamb et al., 1988; Justice et al., 2009; Galindo & Fuller, 2010), such that children with better receptive language ability or who are from families with higher SES often score higher on measures of AC. In addition, receptive language ability, SES, and sex are variables that are often related to EC (Eisenberg, et al., 2010; Allan & Lonigan, 2011), such that girls, children with better early language ability, or children from families with higher SES often score higher on measures of EC.

The Current Study

The current study examined the relations between temperament observed at laboratory visits when children were 42 and 54 months old, and children's AC in early elementary school, as reported by mothers, teachers, and children at 72 and 84 months. First, unique prediction of two aspects of AC, GPA and social-emotional adjustment to school (hereinafter refered to as school adjustment) by temperamental dimensions were examined. Next, interactive effects between each dimension of approach reactivity (impulsivity, positive affect, and frustration) with EC, as well as interactions among the three dimensions of approach reactivity were examined. In order to reduce multicolinearity among the EC and impulsivity factors, separate methodologies were utilized to assess each of these constructs. By using separate methodologies, the aim was to reduce the correlation between these EC and impulsivity enough to estimate reliable interaction effects between these two two variables.

In regard to main effects, it was hypothesized that, after controlling for receptive vocabulary and SES, when EC was not in the model, impulsivity and frustration would negatively predict AC, and positive affect would positively predict AC. When EC was included in the model, it was predicted that impulsivity would either be unrelated or positively related to AC. Both positive affect

and frustration were hypothesized to be unrelated to AC when EC was included in the model. EC was hypothesized to positively predict AC.

In addition, quadratic associations between impulsivity or positive affect and AC were examined. It was hypothesized that without EC in the model, both positive affect and impulsivity would exhibit curvilinear relations with AC, such that these outcomes would be lowest when impulsivity or positive emotion was either very high or very low, but AC would be highest at moderate levels of positive emotion or impulsivity. When EC was entered into the model, both positive emotion and impulsivity were hypothesized to exhibit a curvilinear relationship with AC, such that low levels would be related to poorer outcomes and both moderate and high levels would be related to higher levels of AC.

Finally, interactions between EC and each dimension of approach reactivity and between impulsivity and approach emotions were examined. Regarding the interactions between approach reactivity (i.e. impulsivity, frustration, or positive affect) and EC, it was hypothesized that EC would matter more for children's AC when they experienced high levels of approach reactivity, such that "under-controlled" impulsivity, positive affect, or frustration would be associated with the poorest AC. Regulated positive affect, in particular, may be a quality that is valuable for building peer relationships; however, all "under-controlled" positive affect, frustration, or impulsivity were expected to be negatively associated with both AC outcomes.

Regarding interactions between impulsivity and emotional approach reactivity, less evidence was available with which to formulate hypotheses. It is possible that a "double whammy" effect occurs whereby children with high impulsivity *and* high frustration or positive affect are more likely to have poor AC. Thus, impulsivity would only negatively predict AC when children were also high on another aspect of approach reactivity (i.e. positive affect or frustration). These children may be representative of the surgent or exuberant children. However, it is also possible that impulsivity may buffer against poor AC for children who lack strong emotional responses to goal-based situations. When children have low emotional approach motivation and low impulsivity, they may

lack motivation to approach and engage with the environment in challenging or goal-oriented

contexts (e.g. classroom tasks and/or interacting with peers), and may be more likely to have

lower AC as a result. Thus, impulsivity may be positively related to AC for children who are low in

emotional approach reactivity; but it may be negatively related to AC for children who are high in

emotional approach reactivity.

CHAPTER 2

METHOD

Participants

Participants were part of a longitudinal study examining the development of toddlers'

emotion, emotion regulation, and social-emotional adjustment. Families were initially recruited at

birth from three hospitals in a large metropolitan area in the Southwestern United States. All

infants were born to adult parents and were healthy and delivered full-term. Two hundred and

sixty-five families and their toddlers (n = 114 girls; 43%) participated in the first laboratory

assessment at 18 months. Of these 265, 215 families (81.13%) also participated in laboratory

assessments of temperament at either 42 or 54 months. The majority of the children who

participated at these visits were non-Hispanic (81.9%) and Caucasian (80.5%). The median

annual family income was between $45,000 and $60,000, but ranged from less than $15,000 to

over $100,000. The majority of mothers had completed some college/2-year degree (29.8%) or 4

years of college (35.3%). Some mothers held a high school diploma (14.9%) or a master's

degree (7%). A few mothers did not complete high school (5.1%). The majority of parents were

married (78.6%), and on average had been married 5.18 years when the participating child was

born (SD = 3.89).

Procedure

When children were 42 (N = 188) and 54 months old (N = 163), children and families

participated in laboratory visits. During the lab visits, children participated in tasks aimed at

assessing EC, impulsivity, emotional reactivity, and cognitive development. Also at 42 and 54

months, mothers (ns = 205 and 189) and a non-parental caregiver (ns = 151 and 146) reported

on children's impulsivity. At 72 and 84 months, mothers (ns = 162 and 144, respectively) and

teachers (ns = 144 and 133, respectively) filled out questionnaires regarding children's AC. At 72

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months, most mothers filled these out during a home visit ($n = 150$), whereas others completed the packets via mail and did not participate in the home visit ($n = 12$). At 72 months only, children answered questions regarding their own school liking and avoidance. Mothers and teachers were paid modestly every time they returned a questionnaire packet or participated in a laboratory or home visit, and children were given a small toy for participating in laboratory or home visits.

Measures

  Emotional approach reactivity. Frustration and positive affect were observed during the 42- and 54-month laboratory visits via a series of structured paradigms designed to elicit a specific type of affect.

  Frustration. During a Locked Box task that was utilized to elicit frustration at 42 and 54 months (Stifter & Braungart, 1995; Stifter & Jain, 1996; Stifter, Spinrad, & Braungart-Reiker, 1999), mothers were instructed to work on the questionnaires and to ignore the child's requests for help during the locked conditions. After the child was allowed to play with an attractive toy for approximately 40 seconds, the experimenter locked the toy in a transparent box and handed the child a set of keys. The experimenter explained that the padlock could be opened by the keys and left the room for two minutes. After returning, the experimenter acknowledged that she had given the child the wrong set of keys and allowed the child to play briefly with the toy. Frustration was coded on a scale from no frustration (*1*) to intense frustration (*4*) every 10 seconds during the 2-minute period when the child was alone and the box was locked. Frustration ratings were averaged across epochs (*ICCs* = .80 and .81 at 42 and 54 months, respectively). However, frustration ratings during the locked segments did not significantly correlate across 42 and 54 months, $r(164) = .12$, $p = ns$. Because it was measured closer to the outcome variables, the 54-month time point only was used in subsequent analyses.

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Positive affect. The intensity of children's positive affect was coded in 5-second intervals on a scale from *1* (none) to *4* (intense) during a bubbles with experimenter task at 42 and 54 months. During this task, the experimenter enthusiastically blew bubbles for one minute with the child (e.g. encouraged the child to pop the bubbles, etc.). Positive affect during the relevant epochs was averaged to create one positive emotion variable for each time point (*ICCs* = .71). The two bubbles tasks were positively correlated across time, $r(167) = .40$, $p < .01$, and were averaged together, allowing one time point to be missing, to form a composite positive affect variable.

Impulsivity. Children's latency to approach attractive objects (when no instructions were given) was assessed with two behavioral tasks at the 42- and 54-month lab visits: modified dinky toys and modified gift bag (called "modified" because they differ from the original gift box and dinky toy tasks; Eisenberg et al., 2013; Kochanska, 2000). In addition, mothers and caregivers returned questionnaire measures, either at the laboratory visit or via mail, assessing children's impulsivity at 42 and 54 months.

Observed impulsivity. For both the modified dinky toys and modified gift bag tasks, the child was on the floor and able to move freely around the room, and the experimenter appeared to be putting away materials from the prior task. The experimenter placed the desirable object (either a transparent box of toys or a gift bag) on the ground approximately five feet away from the child and turned her back to the child for about 30 seconds. The child was not given instructions to approach or not to approach the desirable object, and the child's latency to approach the object was coded from the time the experimenter placed it on the ground (*ICCs* = .99 for both tasks at 42 months; *ICCs* = .99 and .96 for the modified gift box and dinky toys tasks at 54 months, respectively). If children did not approach the objects, they received the maximum time for the task. These scores were reverse coded so that high scores indicate high impulsivity. Impulsivity during modified dinky toys was not correlated across 42- and 54-month assessments, $r(159) = .06$, $p = ns$. Impulsivity during modified gift bag tasks were correlated across time, $r(160)$

= .21, $p < .01$. Although impulsivity during modified dinky toys at 54 months was correlated with impulsivity during the modified gift bag task at 42 and 54 months, rs(165 and 163) = .20 and .23, ps <.01, respectively, impulsivity during the modified dinky toys at 42 months was uncorrelated with the 54-month impulsivity variables, rs(161 and 159) = .05 and .06 for modified gift bag and dinky toys, respectively. Thus, the three indicators for observed impulsivity were used in subsequent analyses: modified gift bag tasks at 42 and 54 months and the dinky toys task at 54 months only.

Reported impulsivity. Mothers and caregivers reported on the 13-item impulsivity subscale of the Child Behavior Questionnaire (CBQ, Rothbart et al., 2001). They rated the children's impulsive behavior during the previous week on a scale from *1* (extremely untrue) to *7* (extremely true) on each item (e.g. "often rushes into new situations; *α*s = .77 and .75 for mothers and .74 and .73 for caregivers at 42 and 54 months, respectively). Mothers' and caregivers' reports were averaged across reporter within each time point, rs(147 and 145) = .43 and .38, ps < .01, for 42 and 54 months, respectively. Then, the 42- and 54-month impulsivity composites were averaged together, allowing one time point to be missing, r(184) = .65, $p < .01$.[1]

EC. EC was observed at the 42- and 54-month laboratory assessments during tasks designed to assess different dimensions of the EC construct (bird/dragon, rabbit/turtle, waiting for bow/waiting for gift wrap, dinky toys, and snack delay), and EC was globally rated by laboratory assistants at each time point. Because adult reports of EC and impulsivity items tend to be very highly correlated, mothers' and caregivers' reports of EC items from the CBQ were not included in the latent EC factor.

Bird/Dragon. Children's activational and inhibitory control were assessed with the bird/dragon task at 42 and 54 months (adapted from Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996; Reed, Pien, & Rothbart, 1984). During this task, the experimenter had two

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[1] Questionnaire measures were averaged across reporters within time points, and then time points were averaged together, in order to minimize method effects within structural equation models.

puppets; one was a nice bird, and the other was a mean dragon. The experimenter explained to the child that s/he should only do what the nice bird said and ignore what the mean dragon said. The child was asked to repeat the instructions and completed a few practice trials before the test trials began. The experimenter used the same tone of voice for each puppet and kept them at even height, but moved the appropriate puppet's mouth to indicate who was giving the command. Five bird (activation) and seven dragon (inhibition) commands were given, spaced 2-3 seconds apart (e.g. "touch your ear"). Coders rated children's inhibition on a scale from *1* (child has incorrect response) to *4* (child has completely correct response) during each dragon trial (ICCs = .99) and children's activation during each bird trial (*ICCs* = .99). Because children could still receive a high score by doing nothing on all of the trials, the scores during the activation and inhibition trials were multiplied to form an overall summary of EC. By multiplying the two types of trials, those who appropriately responded to more trials (e.g. activation during activation trials) had the highest EC scores. The bird/dragon EC composites were significantly correlated across 42 and 54 months, $r(167) = .19$, $p < .05$, so they were averaged together, allowing one time point to be missing.

   Waiting for gift bow and gift wrap. Children's ability to delay gratification was assessed in two tasks at 42 and 54 months that involved waiting for a desirable object. During the gift bow task, the experimenter placed a gift box on the table in from of the child and told the child that she forgot the bow. She told the child that she would be right back with the bow and that the child should not touch or open the gift while she was gone (Kochanska et al., 2000). The experimenter left the room for two minutes and returned with the bow. Observers rated children's latencies to touch the box (ICCs = .99, $r(164) = .28$, $p < .001$), open the box (*ICCs* = .99 and 1.0, $r(164) = .23$, $p < .001$), take out the gift (*ICCs* = 1.0, $r(164) = .19$, $p < .05$), and leave their seat (*ICCs* = 1.0, $r(164) = .13$, $p = .10$). The latencies were averaged together within time because they were usually significantly correlated with each other, except between leave seat and touch the box at both 42 and 54 months, $rs(189 \text{ and } 166) = .12$ and $.09$, ps = ns, and between leave the

seat and open the box at 54 months, $r(167) = .15$, $p < .06$. Then, the latency composites were averaged across time, allowing one time point to be missing, $r(165) = .36$, $p < .01$. In order to take into account the longer length of the waiting for bow task compared to the gift wrap task, the latency composite was then divided by 60 to represent latencies while waiting for the bow in minutes.

Children also completed a gift wrap task, during which the child was asked to remain seated and not peek for one minute as the experimenter noisily wrapped a gift behind them (Kochanska et al., 2000). Coders measured children's latency to peek in seconds ($ICCs = .90$ and .72, $r(167) = .25$, $p <.01$). The latency scores were averaged across 42 and 54 months, allowing one time point to be missing, and the gift wrap composite was divided by 60 to represent the latency to peek in minutes; this score was then multiplied by two because the scores were very small when divided by 60. Finally, the gift wrap and gift bow composites were averaged together, allowing one task to be missing, $r(193) = .49$, $p < .01$.

Snack Delay. Children ability to delay gratification was also assessed via a snack delay task involving an M&M (Lab-TAB; Goldsmith & Rothbart, 1999). In this task, the child was allowed to eat an M&M in order to establish that the child liked M&M candy. The experimenter then explained that they were going to play a game where the child was asked to place the M&M on their tongue and keep it there longer than the experimenter, who also placed an M&M on her tongue. Several of practice trials were conducted to ensure that the child understood the rules. If the child needed assistance keeping the M&M on their tongue, s/he was allowed to use one figure to secure it. Three experimental trials were conducted that lasted 20, 30, or 40 seconds. If the child still had an M&M at the end of each trial, the experimenter said, "You won! Let's play again!" If the child swallowed or chewed on the M&M before the trial ended, the experimenter ate her candy and said, "It's a tie! We both ate it, we tied. Let's try again." The child's overall level of restraint was globally coded on a scale from 1 (no attempt at self-restraint) to 4 (child exhibited

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extreme attempt at self-restraint, tried to beat the experimenter during each trial). Restraint scores were averaged across the three trials, $ICC = .93$.

CBR. Four observers (experimenter, graduate student, computer RA, and AV RA) globally rated children's EC during the laboratory visit with two items, attention (i.e., the degree to which the child was focused on the tasks presented by the experimenter; $ICCs = .84$ and $.74$) and persistence (i.e., the degree to which the child persisted at tasks; $ICCs = .73$) on a scale from *1* (consistently lacks attention or persistence) to *5* (consistently attentive or persistent), for each time point, respectively.   Allowing one time point to be missing, the attention and persistence ratings were averaged within time to create an overall EC composite at 42 and 54 months, $rs(192$ and $168) = .87$ and $.50$, $ps < .01$, respectively. The two EC composites were then averaged together, allowing one composite to be missing, $r(167) = .48$, $p < .01$.

Academic competence. Teachers and mothers rated children's AC at 72 and 84 months. At both time points, teachers rated children's school adjustment and children's GPA. Also at both time points, mothers and teachers rated children's school liking and avoidance. At 72 months only, children reported on their own school liking and avoidance.

GPA. Teachers were asked to assign a letter grade (A+ to D or below) to children's overall performance in school at 72 and 84 months. The letter grades were coded on a numeric scale from 1 (D or below) to 10 (A+). This methodology is similar to that used by other studies involving children (Valiente et al., 2013; Valiente et al., 2012), and is based on the "mock reports card" methodology used by Pierce, Ham, and Vandell (1999). GPA ratings were correlated across time, $r(97) = .63$, $p < .01$, and were averaged together, allowing one time point to be missing.

School adjustment. Teachers rated items pertaining to children's school adjustment using the Teacher Rating Scale of School Adjustment (TRSSA; Birch & Ladd, 1997) on a scale from *0* (doesn't apply) to *2* (certainly applies). The cooperative participation subscale was comprised of seven items assessing children's acceptance of the teacher's authority and compliance with classroom rules and responsibilities (e.g. "Follows teacher's directions; $\alpha s = .93$ and $.91$). The

self-directedness subscale was comprised of four items assessing children's autonomous, self-reliant behavior toward classroom and learning activities (e.g. "works independently"; αs = .86 and .84). The two subscales were significantly correlated with each other, rs(134 and 132) = .68 and .61, at 72 and 84 months, respectively, and were averaged together at each time point. Teachers' ratings on this composite were significantly correlated across time, r(108) = .49, p < .01, and averaged into one classroom participation composite, allowing one time point to be missing.

School liking and avoidance. Teachers and mothers rated the degree to which children liked or tried to avoid school on a scale from 1 (almost never applies) to 3 (certainly applies) using the School Liking and Avoidance Questionnaire (SLAQ; Ladd & Price, 1987). A subscale assessed children's school liking (e.g. "has fun at school"; seven and five items) at 72 (αs = .85 and .80) and 84 months (αs = .79 and .83) for teachers and mothers, respectively. Another subscale assessed children's school avoidance (e.g. "asks to leave the classroom"; six and five items) at 72 (αs = .81 and .94) and 84 months (αs = .92 and .68) for teachers and mothers, respectively. Avoidance items were reversed, and liking and avoidance items were averaged (school liking and avoidance) for each reporter and each time point. The reliability of the avoidance/liking items was acceptable at 72 (αs = .87 and .92) and 84 months (αs = .83 and .92), for teachers and mothers, respectively. Within time, mothers' and teachers' reports on the overall composite were correlated, rs(132 and 119) = .29 and .37, ps < .01, for 72 and 84 months, respectively. Mothers' and teachers' reports were averaged together at each time point, allowing one reporter to be missing, in order to create one SLAQ composite at 72 and 84 months. Then, the 72- and 84-month SLAQ composites, which were significantly correlated across time, r(149) = .56, p < .01, were averaged together, allowing one time point to be missing.

During a home visit at 72 months (n = 150), children self-reported their own school liking (six items; e.g. "When you get up in the morning, do you feel happy about going to school?"; α = .74) and avoidance (three items; e.g. "Do you wish you could stay home from school?"; α = .68) with

an adapted version of the SLAQ. In response to each question, children responded either "no" (0), "sometimes" (1) or "yes" (2). Avoidance items were reversed and averaged with the school liking items to form one overall SLAQ composite (α = .79).

Covariates. Mothers reported children's sex, their own education, father's education, and the annual family income at multiple time points throughout the study. Using 54 months as a reference time point, demographic variables for the SES composite were used at the time point closest to 54 months, if the 54-month data were missing. Parents' education was standardized and averaged across mother and father (if information on father was available), and the education and income variables were standardized and averaged to form the SES composite. In order to control for children's early receptive language ability, children were administered the Wechsler Preschool and Primary Scale of Intelligence-Third Edition (WPPSI-III; Sattler & Dumont, 2004) receptive vocabulary subtest at 54 months. This 38-item subtest assesses children's word knowledge and their formation of concepts, memory, store of information, and depth of thought by asking children to indicate which picture of four pictures presented best represented a word spoken by the experimenter.

Attrition Analyses

Out of the 265 families who participated in the first laboratory visit at 18 months, 50 families (18.87%) did not participate in laboratory measures of temperament or did not return questionnaire packets regarding children's impulsivity at either 42 or 54 months. These children were more likely to come from families with lower SES, t (263) = 2.08, $p < .05$, and have younger mothers, t (240) = 2.95, $p < .01$, and fathers, t (233) = 2.85, $p < .01$. These children were also more likely to be Hispanic than non-Hispanic, X^2 (1) = 3.83, $p < .05$. Forty-nine out of the 215 families (22.79%) who participated in laboratory visits at 42 or 54 months did not return questionnaires on children's AC at either 72 or 84 months old.

Independent samples *t* tests were conducted to examine whether attrition from the

sample over time was related to demographic information or study variables. Results with non-

integer degrees of freedom indicate the homogeneity of variances assumption had been violated

and the adjusted results were reported. Compared to children with at least some data at 42 or 54

months and 72 or 84 months, children who attrited before 72 or 84 months came from families

with lower SES, $t(213) = 2.16$, $p < .05$, and had younger mothers, $t(196) = 2.03$, $p < .05$, and

fathers, $t(87.42) = 2.13$, $p < .05$. These children were also more likely to have parents who were

married for less time, $t(71.97) = 2.75$, $p < .01$. Regarding study variables, children who attrited

before 72 or 84 months were more likely to have lower EC during the bird/dragon task, $t(190) =$

3.53, $p < .01$, and they were also rated as having lower EC on the CBR, $t(191) = 2.02$, $p < .05$.

These results indicate that including SES in subsequent SEM models may help account for

missing data patterns.

Data Analytic Plan

First, all variables were examined for excessive univariate skewness and kurtosis using

SPSS AMOS 22.0 (skewness ≥ 2 or kurtosis ≥ 7). Univariate non-normality was adjusted by

recoding outliers ($z ≥ 3.00$) to just above/below (depending on the direction of skew) the nearest

non-outlier value. This approach retains outliers in the analysis rather than dropping them

completely from the sample, but recodes extreme values so they do not exert undue statistical

influence on subsequent models. Next, zero-order correlations were conducted in MPLUS 6.11

and full-information maximum likelihood estimation (FIML) was utilized in order to account for

missing data among all variables of interest.

All SEM models were estimated using FIML in MPLUS version 6.11. Guidelines for global

fit indices were adopted from Little (2013). A model with a chi-square with $p > .05$, RMSEA≤ .05,

CFI≥ .95, and SRMR≤ .08 indicated very good fit (Little, 2013; Hu & Bentler, 1999). Acceptable fit

indices also included RMSEA between .05 and .08, and CFA between .90 and .99 (Little, 2013, p

109, 115). A large CFA model was estimated to establish the fit of all latent variables: impulsivity (during modified dinky toys at 54 months, modified gift bag at 42 and 54 months, and from adult reports of impulsivity), EC (during bird/dragon, gift bow/gift wrap latencies, and snack delay, as well as from raters' reports of EC during laboratory tasks), and school adjustment (teacher-reported participation, adult-reported SLAQ, and child self-reported SLAQ). Next, two separate CFA models were estimated for impulsivity and EC in order to eliminate the covariance between these factors in the computation of the factor scores. Factor scores were calculated only for these latent predictors in order to avoid estimating latent variable interactions during hypothesis testing, which requires larger sample sizes in order to achieve adequate power to detect small-moderate interaction effects (Kelava et al., 2011). Factor scores were separately calculated in each of these one-factor CFA models using the SAVEDATA command in MPLUS 6.11. By default, MPLUS calculated the factor scores by estimating the maximum of the posterior distribution of the factor (also called the regression method). By calculating factor scores in this way, regression slopes were not biased when using factor scores as predictors (Skrondal & Laake, 2001). Grice (2001) recommends that these factor scores have a degree of determinacy of .80 or higher.

Once good-fitting CFAs were established, a direct effects model was estimated that specified direct paths from temperamental predictors (factor scores for impulsivity and EC, observed scores for frustration and positive affect) to outcome variables (latent school adjustment variables and observed GPA). For ease of interpretation, covariances between predictors and continuous covariates (SES and vocabulary) were freely estimated, and SES and vocabulary directly predicted outcome variables. In addition, all study variables (predictors and outcomes) were regressed on sex (0 = male; 1 = female).

In a series of models, hypothesis testing was then conducted. First, the direct effects from temperament to outcome variables were estimated (Hypothesis 1). Because sex was included as a covariate in the analyses, measurement invariance of the AC model was established across separate models for boys and girls. Then, invariance of direct effects from

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temperament to outcomes for boys and girls was tested. Second, nonlinear effects from temperament to outcome variables were estimated. Nonlinear (i.e., quadratic and interactive) effects were calculated by multiplying the two interacting variables together (i.e., quadratic terms were computed by multiplying the variable by itself). Quadratic effects of impulsivity or positive emotion on AC were estimated in separate models (Hypothesis 2). Then, interaction effects between EC and each dimension of approach reactivity were estimated in separate models including the main effects and covariates (Hypothesis 3). Finally, interaction effects between impulsivity and each emotion were similarly estimated in separate models including the main effects and covariates (Hypothesis 4).

CHAPTER 3

RESULTS

Descriptives and Preliminary Correlations

  Descriptives. Teacher-rated school liking and avoidance at both time points and mother-rated school liking and avoidance at 72 months were excessively negatively skewed (skewness ≤ -2). Because many of the extreme cases on these variables overlapped across reporter, SLAQ outliers were recoded after creating the final composite, first averaging across reporters within time and then averaging the adults' reports across time. The final SLAQ composite was created and examined for outliers. Three cases remained extremely low relative the rest of the distribution ($z <$ -3.00), and were recoded to just below the nearest non-outlier value (to $z =$ -2.86), which normalized the skew of the distribution. The descriptives for the recoded SLAQ composite are presented in Table 1. All other variables were normally distributed.

  Correlations among predictors and covariates. Table 2 presents the correlations among all temperament variables and covariates. To account for missing data, MPLUS was utilized for correlation analyses. Frustration was positively related to adult-reported impulsivity, $r = .22$, $p < .01$, EC during the snack delay, $r = .13$, $p < .10$, and EC during the bird/dragon task, $r = .16$, $p < .05$. Positive emotion during the bubbles task was unrelated to impulsivity, but was positively related to all EC variables except during snack delay, rs between .14 and .23, ps < .05. All impulsivity variables were significantly related to each other, rs between .16 and .23, ps < .05. Additionally, all EC variables were significantly related to each other, rs between .23 and .63, ps < .01. All impulsivity variables were at least marginally negatively related to CBR EC ratings and EC during the gift wrap/waiting for bow tasks, rs between -.15 and -.27, $p < .10$ to $p < .01$, with the exception of modified dinky at 54 months and gift wrap/waiting for bow tasks, $r =$ -.12, $p = ns$. Only impulsivity during the modified gift task at 42 months was negatively related to EC during

bird/dragon, $r = -.18$, $p < .01$, and impulsivity variables were unrelated to EC during the snack delay.

Covariates were also significantly related to many of the temperament variables. Receptive vocabulary was positively related to frustration during the locked box task and all EC variables, rs between .13 and .41, ps < .10 to p < .01, and it was negatively related to all impulsivity variables, rs between -.19 and -.25, ps < .01, except modified gift task at 54 months (although they were related to some degree, $r = -.11$). Vocabulary was unrelated to positive emotion. SES was negatively related to all impulsivity variables, rs between -.16 and -.22, ps < .05 to .01, except modified gift task at 42 months (although they were related to some degree, $r = -.11$), and SES was positively related to all EC variables, rs between .25 and .32, ps < .01, with the exception of EC during the snack delay, $r = .07$, $p = $ ns. Girls expressed more positive emotion than did boys during the bubbles task, $r = .18$, $p < .05$. Boys exhibited more impulsivity in observed tasks, rs between -.13 and -.15, ps < .10 to .05, but there were no sex differences in adult-reported impulsivity, $r = -.08$, $p = ns$. Girls had higher scores on all EC variables, rs between .20 and .25, ps < .01, with the exception of EC during the bird/dragon task, $r = .10$, $p = ns$. These results suggest that SES, vocabulary, and sex were related to temperament variables and should be included as covariates in subsequent models.

Correlations among outcome variables and covariates. Next, correlation analyses were conducted in MPLUS to assess relations among all outcome variables and covariates (Table 3). All AC variables were significantly related to each other, rs between .29 and .63, ps < .01. Receptive vocabulary was positively related to all outcome variables, rs between .21 and .50, ps < .01, with the exception of child-reported school liking and avoidance, $r = .10$, $p = ns$. SES was positively related to all outcome variables, rs between .15 and .40, ps < .05 to .01. Finally, girls had significantly higher scores on adult-rated school liking and avoidance, $r = .25$, $p < .01$, and teacher-rated participation, $r = .33$, $p < .01$. These results suggest covariates were significantly related to AC outcome variables as well as temperamental predictors.

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CFA Models

First, a 3-factor CFA was conducted in MPLUS 6.11 that examined the fit of a model that simultaneously specified latent factors for EC, impulsivity, and school adjustment. Then, two CFAs were conducted which separately specified latent impulsivity and EC factors. The CFI value for the impulsivity CFA that was outputted by MPLUS was inaccurate for longitudinal data because the comparative null model did not take into account the repeated measurement of the modified gift task over time. Thus, a corrected CFI was calculated that represented an appropriate null model, which specified no covariances among variables and equal means and variances for the modified gift task over time (Little, 2013, p 115; referred to as CFI* where applicable). Factor scores were calculated from each separate CFA model once adequate model fit had been established. These factor scores were then used in subsequent SEM models that estimated direct and interactive effects from temperament to AC.

CFA with all latent factors. A three-factor CFA model was estimated that specified latent impulsivity, EC, and school adjustment variables (Figure 1). This model included 215 children and fit the data well, $X^2(40) = 43.26$, $p = $ ns, RMSEA= .02 (p RMSEA < .05 = .93), CFI* = 1.00, SRMR = .05. Although it was not necessary for this CFA to fit well, subsequent path analysis models with factor scores for EC and impulsvity suggested that the residual variances of child and adult reports of school liking and avoidance needed to covary in order for the models to fit well. The correlation between these two residual variances was statistically significant, $r = .24$, $p < .05$. All items loaded significantly and positively onto their respective factors, and all items had significant residual variances not accounted for by the latent factors. The variances for all of the latent factors were significantly greater than zero, indicating significant individual variability in each of these factors, $\sigma^2 s = 34.55$, 4.01, and .12 for impulsivity, EC, and school adjustment factors, respectively. EC and impulsivity were strongly negatively correlated, $r = -.56$, $p < .01$. Impulsivity was also negatively correlated with school adjustment, $r = -.55$, $p < .01$. EC was positively correlated school adjustment, $r = .60$, $p < .01$.

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Impulsivity. An impulsivity CFA was specified that included all four impulsivity variables (adult-reported impulsivity, modified gift bag tasks at 42 and 54 months, and the modified dinky toys task at 42 months). This model (Figure 2) included 215 children and fit the data well, $X^2(2) =$ 0.10, $p = ns$, RMSEA= .00 (p RMSEA < .05 = .97), CFI* = 1.00, SRMR = .01. All impulsivity items loaded significantly onto the latent impulsivity factor, standardized λ = .46, .49, and .46, and .36 for modified gift at 42 months, modified gift at 54 months, modified dinky at 54 months, and adult-reported impulsivity, respectively. The R^2 values were 21.1%, 23.7% 21.2% and 12.7%, respectively. The variance of the latent impulsivity factor was significantly greater than zero, $\sigma^2 =$ 33.84, $p < .05$, indicating there were individual differences for this impulsivity factor. The determinacy value for the impulsivity factor score calculated from this model was .71, slightly lower than the .80 recommended by Grice (2001). The factor score for this impulsivity CFA was extracted and used in subsequent SEM models.

EC. An EC CFA was specified that included all four EC variables (Bird/dragon, CBR, snack delay, and gift wrap/waiting for bow latencies). This model (Figure 3) included 194 children and fit the data well, $X^2(2)$ = 3.08, $p = ns$, RMSEA= .06 (p RMSEA < .05 = .37), CFI = .99, SRMR = .02. All EC items loaded significantly onto the latent EC factor, standardized λ = .84, .58, .75, and .42, for the CBR, bird/dragon, gift wrap/bow, and snack delay variables, respectively. The R^2 values were 70.9%, 33.7%., 56.1%, and 17.7%, respectively. The variance of the latent EC factor was significantly greater than zero, σ^2 = 0.32, $p < .01$, indicating there were individual differences in this EC factor. The determinacy for the EC factor score computed from this model was .90. The factor score was extracted from this EC CFA and used in subsequent SEM models.

Correlations between Temperament and Outcomes by Sex.

Correlations between temperament and AC were conducted in MPLUS 6.11 (see Table 4). Frustration was unrelated to any AC outcome, rs between -.01 and .12, ps = ns. Positive emotion during the bubbles task was positively related to class participation, r = .22, $p < .01$, and

adult reports of school liking and avoidance, $r = .18$, $p < .05$. Zero-order correlations indicated the factor score for impulsivity was negatively related to class participation, $r = -.27$, $p < .01$, and GPA, $r = -.17$, $p < .05$; however, the observed impulsivity items were less consistently related to these outcomes than adult reports of impulsivity were. The factor score for EC was positively related to all AC outcomes, rs between .30 and .41, ps < .01.

In order to explore the possibility that sex differences were present in the relations between variables of interest, correlations between temperament and AC were conducted separately for each sex. Fishers' r-to-z transformation (i.e., hyperbolic arctangent; Weaver & Wuensch, 2013; Fisher, 1921) was computed for each correlation in Table 4 and significant differences in z scores assessed whether correlations differed for girls and boys. Results indicated there were some sex differences in the relations among study variables. Several correlations indicated significant relations were present mainly for girls, but not for boys. Whereas frustration was positively related to GPA for girls, $r = .20$, $p < .10$, frustration was unrelated to GPA for boys, $r = -.05$, $p = ns$, $z = -1.98$, $p < .05$. Impulsivity was more strongly negatively related to EC for girls, $r = -.37$, $p < .01$, than for boys, $r = -.12$, $p = ns$. Alternatively, although EC was related to GPA for both boys and girls, EC was more strongly related to GPA for boys than for girls, rs = .50 and .26, ps < .01, for boys and girls, respectively, $z = 2.22$, $p < .05$. Although there were sex differences present in correlation analyses, it is unclear whether these sex differences would persist in path analyses models that estimate unique prediction, rather than zero-order relations, of school adjustment or GPA by temperament, vocabulary, and SES.

Hypothesis Testing

Sex invariance in the direct effects model. Because regression coefficients representing the paths from sex to other variables would be considered biased unless measurement invariance could be established for both boys and girls (Millsap, 1997), a series of multiple group models assessed the assumptions of measurement invariance in the AC model for

both boys and girls. Nested models were compared using likelihood ratio chi-square tests. Table 5 lists the fit indices for each of the models establishing measurement and structural invariance of the AC model across boys and girls (Models 1-2).

Measurement invariance. Model 1a freely estimated the loadings and intercepts of items onto the school adjustment factor and the paths from temperament to school adjustment and GPA for boys and girls. This model fit the data well, $X^2(26) = 24.06$, $p = ns$, RMSEA = .00 (p RMSEA < .05 = .87), CFI = 1.00, SRMR = .04, with $X^2(13) = 14.36$ in the boys' group and $X^2(13) = 9.70$ in the girls' group, both ps = ns. Model 1a was then compared to a model in which loadings of corresponding school adjustment items were held invariant across boys and girls (Model 1b). This model fit the data well, $X^2(28) = 25.62$, $p = ns$, RMSEA = .00 (p RMSEA < .05 = .89), CFI = 1.00, SRMR = .07, and constraining the loadings to be equal in both groups did not significantly worsen the fit of Model 1a, $X^2\Delta(2) = 1.56$, $p < .05$. Next, a model with intercepts and loadings of school adjustment items held invariant across boys and girls was estimated (Model 1c). This model did not fit the data well, $X(31) = 54.60$, $p = ns$, RMSEA = .05 (p RMSEA < .05 = .09), CFI = .85, SRMR = .13, so Model 1d constrained all intercepts to be equal except the class participation intercept. Model 1d fit the data well, although the SRMR was higher than a recommended value, $X^2(30) = 37.79$, $p = ns$, RMSEA = .08 (p RMSEA < .05 = .54), CFI = .95, SRMR = .11; however, Model 1d significantly worsened the fit of Model 1b, $X^2\Delta(2) = 12.17$, $p < .05$. Finally, Model 1e only constrained the child-reported school liking intercepts to be equal for boys and girls but freely estimated the participation and adult-reported school liking intercepts. This model fit the data well, $X(29) = 26.06$, $p = ns$, RMSEA = .00 (p RMSEA < .05 = .91), CFI = 1.00, SRMR = .07, and it did not worsen the fit of Model 1b, $X^2\Delta(1) = 0.44$, $p = ns.$ Thus, the AC measurement model was found to be partially invariant across sex.

Structural invariance. Building upon Model 1e, a model that constrained all of the paths from predictors to AC outcomes to be equal across boys and girls was specified (Model 2). This model fit the data well, $X^2(41) = 39.35$, $p = ns,$ RMSEA = .00 (p RMSEA < .05 = .91), CFI = 1.00,

SRMR= .10. Moreover, this model did not significantly worsened the fit of model 1e, $X^2\Delta(12) =$ 13.28, $p = ns$; this indicated that the path coefficients from temperament or covariates to AC outcomes were statistically equivalent for boys and girls. Thus, sex was included in subsequent direct effects models as a predictor of AC outcomes, as well as a predictor of temperament and vocabulary, because of significant results of independent t tests.

Hypothesis 1: Direct effects. In the direct effects models, sex, positive affect, frustration, vocabulary, SES, and factor scores for impulsivity and EC were included as direct predictors of both GPA and the latent school adjustment factor. Sex also directly predicted frustration, positive affect, vocabulary, and factor scores for impulsivity and EC. Table 5 lists the fit indices for models involving hypothesis testing for the AC model (Models 3-6). Models 3a and 3b examine differences in direct effects when excluding (3a) and including (3b) EC as a predictor.

Direct effects without EC. Model 3a, as illustrated in Figure 4, included 255 children and fit the data well, $X^2(14) = 14.25$, $p = ns$, RMSEA= .01 (p RMSEA < .05= .87), CFI = 1.00, SRMR = .03. Positive affect and vocabulary significantly predicted school adjustment, $bs = 0.14$ and 0.05, $z = 2.30$ and 4.03, $ps< .05$, and only vocabulary significantly predicted GPA, $b = 0.35$, $z = 5.77$, $p < .01$. Sex significantly predicted school adjustment but not GPA, $r = 0.55$, $z = 3.41$, $p < .01$, such that girls scored higher than boys on school adjustment. Sex also predicted frustration, positive affect, impulsivity, and vocabulary, $rs = -0.28$, 0.37, -0.43, and 0.29, $zs= -1.83$, 2.66, -3.40, and 2.10, $ps< .10$ for frustration, and < .05 for others, respectively. Thus, girls had higher positive affect, vocabulary, and school adjustment, and lower frustration and impulsivity than boys. School adjustment and GPA were highly correlated, $r = .63$, $z = 7.37$, $p < .01$. R^2 values indicated that the model predicted 37.0% of the variance in school adjustment and 27.0% of the variance in GPA, $zs = 4.11$ and 4.06, $ps < .01$, respectively.

Direct effects with EC. Model 3b, as illustrated in Figure 5, included 255 children and fit the data well, $X^2(16) = 22.09$, $p= ns$, RMSEA= .04 (p RMSEA< .05= .66), CFI = .98, SRMR= .04. When EC was included in the model, only EC and vocabulary positively predicted both school

adjustment, bs = 0.18 and 0.04, zs = 2.43 and 3.06, ps < .05, and GPA, bs = 0.87 and 0.30, zs = 2.23 and 4.78, ps < .05. Sex predicted school adjustment, temperament, and vocabulary variables similarly to model 3a. Also similarly to model 3a, GPA and school adjustment were highly correlated, r = .62, z = 7.12, p < .01. This model also predicted a significant proportion of the variability in school adjustment, R^2 = 42.4% and 30.2%, zs = 4.50 and 4.49, ps < .01, for school adjustment and GPA, respectively.

Hypothesis 2: Quadratic effects of impulsivity and positive affect. Table 5 lists the models that estimated quadratic effects for impulsivity or positive affect (Models 4a- 4b). Two models assessed the effects of quadratic impulsivity on AC: 4ai) when EC was also in the model and 4bi) when EC was not in the model. Similarly, two models assessed the effects of quadratic positive affect on AC: 4aii) when EC was also in the model, and 4bii) when EC was not in the model. In all cases, quadratic terms were computed by multiplying the temperament variable of interest (i.e. either impulsivity or positive affect) by itself. All predictors from the direct effects model were included in the quadratic models, covariances between the quadratic variable and other predictors were freely estimated, and paths were also estimated from the quadratic variable to school adjustment and GPA. Because these models were not nested in the direct effects model, quadratic models were compared to the direct effects model by assessing the significance of the quadratic effect in the model.

Quadratic impulsivity. Model 4ai, which included EC in the model, fit the data well, X^2(18) = 24.06, p = ns, RMSEA = .04 (p RMSEA < .05 = .71), CFI = .98, SRMR = .04. The quadratic effect of impulsivity on school adjustment or GPA was not significant, bs = -0.00 and -0.00, zs = -0.51 and -0.32, ps = ns, respectively.   Model 4bi, which did not include EC in the model, fit the data well, X^2(16) = 14.32, p = ns, RMSEA = .00 (p RMSEA < .05 = .94), CFI = 1.00, SRMR = .03. The quadratic effect of impulsivity on school adjustment or GPA was not significant, bs = -0.00 and -0.00, zs = -0.31 and -0.41, ps = ns, respectively. Thus, impulsivity did not exhibit a quadratic relation with AC outcomes with or without EC in the model.

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Quadratic positive affect. Model 4aii, which included EC in the model, fith the data well, $X^2(18) = 23.31$, $p = ns$, RMSEA = .03 (p RMSEA < .05 = .74), CFI = .98, SRMR = .04. The quadratic effect of positive affect on school adjustment or GPA was not significant, bs = 0.04 and -0.30, zs = 0.46 and -0.62, ps = ns. Model 4bii, which did not include EC in the model, fit the data well, $X^2(16) = 15.22$, $p = ns$, RMSEA = .00 (p RMSEA < .05 = .92), CFI = 1.00, SRMR = .03. The quadratic effect of positive affect on school adjustment or GPA was not significant, bs = 0.01 and -0.45, zs = 0.11 and -0.93, ps = ns. Thus, positive affect did not exhibit a quadratic relation to AC, with or without EC in the model.

Hypothesis 3: Interactions between EC and dimensions of approach reactivity.

Table 5 lists fit indices for models (5a–5c), which estimated in separate models the prediction of school adjustment and GPA from the interaction between EC and a dimension of approach reactivity: 5a) EC x positive affect, 5b) EC x frustration, and 5c) EC x impulsivity. In all cases, interaction terms were computed by multiplying the two temperament variable of interest. All predictors from the direct effects model (including the covariates) were included in the interaction models, covariances between the interaction terms and other predictors/covariates were freely estimated, and paths were also estimated from the interaction variable to school adjustment and GPA. Because these models were not nested in the direct effects model, interaction models were compared to the direct effects model by assessing the significance of the interaction effect.

EC x positive affect. Model 5a estimated an interaction effect between EC and positive affect over-and-above the direct effects of temperament, vocabulary, SES, and sex. This model fit the data well, $X^2(18) = 22.93$, $p = ns$, RMSEA = .03 (p RMSEA < .05 = .75), CFI = .99, SRMR = .04. The interactive effects of EC and positive affect on school adjustment and GPA were marginally significant, bs = -0.21 and -1.16, zs = -1.79 and -1.87, ps = 07 and .06. Figures 6a and 6b illustrate the interactive effect predicting school adjustment (6a) and GPA (6b). The simple slopes of EC were assessed at -1 standard deviation of positive affect, average positive affect, and +1 standard deviation of positive affect (Aiken & West, 1991). The simple effect of EC

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was only statistically significant for children with average, bs = 0.88 and 0.18, zs = 2.26 and 2.49, ps < .05, or low positive affect, bs = 1.50 and .29, zs = 2.92 and 3.03, ps < .01, for school adjustment and GPA, respectively; EC was unrelated to school adjustment or GPA for children with high positive affect, bs = 0.26 and 0.07, zs = 0.52 and 0.74, ps = $ns.$ Children with high positive affect tended to have higher GPA and school adjustment regardless of their EC, whereas EC mattered for children's AC if they had low or moderate positive affect.

EC x frustration. Model 5b estimated an interaction effect between EC and frustration over-and-above the direct effects of temperament, vocabulary, SES, and sex. This model fit the data well, X^2(18) = 24.25, p = ns, RMSEA = .04 (p RMSEA < .05 = .70), CFI = .98, SRMR = .04. The interactive effect of EC and frustration on school adjustment was marginally significant, b = 0.35, z= 1.85, p = .07. However, the interactive effect of EC and frustration on GPA was not significant, b = 1.17, z = 1.14, ps = $ns.$ Figure 7 illustrates the interaction between EC and frustration predicting school adjustment. EC was positively related to school adjustment only when children had average, b = 0.16, z = 2.24, p < .05, or high frustration, b = 0.28, z = 3.07, p < .01. Among children who expressed low levels of frustration during the locked box task, EC was unrelated to school adjustment, b = 0.04, z = 0.43, p = $ns.$ Children with low frustration had similar high levels of school adjustment regardless of EC, whereas EC mattered for children's school adjustment if they had moderate or high frustration.

EC x impulsivity. Model 5c estimated an interaction effect between EC and impulsivity over-and-above the direct effects of temperament, vocabulary, SES, and sex. This model fit the data well, X^2(18) = 21.89, p = ns, RMSEA = .03 (p RMSEA < .05 = .79), CFI = .99, SRMR = .04. The interactive effect of EC and impulsivity on school adjustment was not significant, b = 0.01, z = 0.46, p = $ns.$ However, the interactive effect of EC and impulsivity on GPA was statistically significant, b = 0.18, z = 2.09, p < .05. As is illustrated in Figure 8, EC was only positively related to GPA for children with average, b = 0.73, z = 1.86, p < .10, or high impulsivity, b = 1.40, z = 3.05, p < .01, whereas EC was unrelated to GPA for children with low impulsivity, b = 0.06, z =

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0.12, *p* = *ns*. Children with low impulsivity had similar GPA regardless of EC, whereas EC

mattered for children's GPA for children with average or high impulsivity.

Hypothesis 4: Interactions between impulsivity and emotional approach reactivity.

Table 5 lists the fix indices for models that estimated the interactive effects of impulsivity and

positive affect (Model 6a) and impulsivity and frustration (Model 6b) over and above the direct

effects of temperament, vocabulary, SES, and sex. In both cases, interaction terms were

computed by multiplying the two temperament variable of interest. Covariances between the

interaction variable and other predictors were freely estimated, and paths were estimated from

the interaction variable to school adjustment and GPA. Because these models were not nested

in the direct effects model, interaction models were compared to the direct effects model by

assessing the significance of the interaction effect.

Impulsivity x positive affect. Model 6a estimated an interaction effect between impulsivity

and positive affect over-and-above the direct effects of temperament, vocabulary, SES, and sex.

This model fit the data well, X^2 (18)= 23.29, *p* = *ns*, RMSEA = .03 (*p* RMSEA< .05 = .74), CFI =

.98, SRMR = .04. The interactive effect of impulsivity and positive affect on school adjustment

was not significant, *b* = 0.02, *z* = 1.27, *p*s = *ns*, respectively. However, the interactive effect

predicting GPA was statistically significant, *b* = 0.22, *z* = 2.86, *p* < .01. As is illustrated in Figure

9, impulsivity was positively related to GPA when children were high in positive affect, *b* = 0.14, *z*

= 2.33, *p* < .05*.* Although the simple slope was not statistically significant from zero, impulsivity

was negatively related to GPA when children had low positive affect, *b* = -0.09, *z* = -1.62, *p* = *ns.*

Impulsivity was unrelated to GPA when children had average positive affect. Thus, impulsivity

was differentially related to children's GPA for children with low or high positive affect.

Impulsivity x frustration. Model 6b estimated an interaction effect between impulsivity and

frustration over-and-above the direct effects of temperament, vocabulary, SES, and sex. This

model fit the data well, X^2 (18) = 24.59, *p* = *ns*, RMSEA = .04 (*p* RMSEA < .05 = .68), CFI = .98,

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SRMR = .04. The interactive effect of impulsivity and frustration on school adjustment or GPA

was not significant, bs = 0.01 and 0.03, zs = 0.52 and 0.23, ps = ns, respectively.

CHAPTER 4

DISCUSSION

Despite the abundance of work on how temperament relates to AC during early childhood, there is a surprising lack of research that has examined the unique effects of observed impulsivity and emotional reactivity in contexts involving appetitive stimuli; these observed (rather than reported) measurements of temperamental approach reactivity are surprisingly lacking in the literature. Even fewer studies have examined these effects by including EC in the same model in order to examine unique effects of each temperamental dimensions on AC. Moreover, the current study examined these relations after controlling for vocabulary, which strongly relates to standardized achievement tests in childhood, independent of self-regulation (Duckworth, Quinn, & Tsukayama, 2012). As is supported by literature in this area, the results of the current study indicated that EC and vocabulary were strong, positive predictors of AC. However, these results also add to this body of literature by examining how dimensions of approach reactivity were related to AC, independent of these strong, direct predictors. In addition, this study replicated findings from previous literature on interactions between EC and impulsivity or frustration using observed measures of impulsivity and frustration, a method which has not been done before, according to my knowledge.

Impulsivity: Complex Relations with AC

One of the main findings of this study is that impulsivity was not in-and-of-itself detrimental for young children's AC, as has been indicated in previous research with younger children. Although impulsivity was negatively related to school adjustment in both zero-order correlation and CFA analyses, it did not directly predict AC in path analysis models; nor was there a quadratic relation found between impulsivity and AC, either with or without EC included as a predictor in the model. It was hypothesized that impulsivity may exhibit significant negative relations with AC, particularly when EC was excluded from the model. However, the lack of unique prediction by impulsivity, regardless of EC inclusion, indicates that impulsivity did not predict AC, over-and-above the

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effects of positive affect and vocabulary, which also significantly predicted higher AC in path analysis models. Rather than direct prediction of AC, impulsivity interacted with both EC and positive affect to predict GPA, but not school adjustment.

    Direct relations. The lack of direct effects involving impulsivity in the current study is in contrast to work with young adolescents which has shown that impulsivity significantly predicted academic outcomes over-and-above the effects of EC (Valiente et al., 2013). It is possible that, in young children, impulsivity is not a direct predictor of AC, after controlling for EC, but its relation with AC may become more independent of EC as children age. Thus, in samples of older children, EC and impulsivity may both directly predict AC in path analysis models because impulsivity may become a more defined trait, independent of its relation with EC, as children age. This developmental explanation would also support the lack of significant quadratic effects involving impulsivity in the current study, in which impulsivity was measured when children were 3.5-4.5 years old. Previous significant quadratic associations with impulsivity have also been found in a sample of older children when predicting academic achievement (Valiente, et al., 2013).

    Specifically, it is possible that impulsivity may indirectly predict school adjustment in early elementary school through resiliency development in children ages 4.5 to 8 years old. Impulsivity and EC uniquely and positively predicted resiliency in high-risk and typical samples of young children (Eisenberg, Spinrad, & Morris, 2002). Moreover, Eisenberg and colleagues also noted that moderate, rather than high or low, impulsivity predicted higher resiliency in a sample including high risk and low risk children. Thus, future work should examine whether impulsivity relates to AC in elementary school through resiliency development throughout early childhood. Such work may clarify pathways through which impulsivity may be positively related to AC in early elementary school.

    Because impulsivity was measured 1-2 years before AC in the current sample, it is also possible that significant main effects were not found in relation to AC because impulsivity may be

developing at a more rapid pace during this time than EC, positive affect, or frustration. In a study with similar-aged children, Spinrad and colleagues (2004) found that early impulsivity negatively predicted later popularity, but early popularity positively predicted later impulsivity, independent of EC in longitudinal path analysis models. Possibly because of power restrictions in longitudinal path analysis models and the difficulty of obtaining the same assessments of impulsivity across time, Spinrad and colleagues measured impulsivity and EC only by adults' reports. Out-of-bounds estimates were reported in the results section, likely because of the degree of colinearity between EC and impulsivity, due to identical assessment methodology. An advantage of the current study is that multiple assessments of EC and impulsivity were utilized to separately calculate latent factor scores, effectively decreasing the correlation between the two constructs in subsequent SEM models, allowing for more reliable estimates involving the interaction between impulsivity and EC. However, given the changing relations between impulsivity and popularity, independent of EC, that were reported by Spinrad and colleagues, it is possible that growth patterns of impulsivity during early childhood, rather than rank-order differences, as were examined in the current study, may better predict AC. Future longitudinal work should examine the possibility that the patterns of impulsivity development in early childhood uniquely predict later AC, independent of EC.

In addition, the results presented by Spinrad and colleagues (2004) suggest that children's social norms regarding classmates' approach behavior may change throughout early elementary school. It is possible that unregulated approach behavior may be more detrimental for children's social skills and/or social status later in elementary school than in kindergarten. Just as teachers' increase their expectations for children to display situationally appropriate behavior as children age, it is also possible that children's expectations of their peers' situationally appropriate behavior also evolve during early elementary school. Future work should seek to understand how children's view of impulsivity in peers changes over the course of childhood. Work in this area may clarify why impulsivity is either negatively related (Demaray & Jenkins, 2011; Glenwick,

1976; Wagner et al., 2011) or unrelated (Lengua, 2003; the current study) to school adjustment-related aspects of AC in studies involving young children.

Finally, it is possible that impulsivity was not directly related to AC in the current study because impulsivity was measured with observed as well as reported methodologies. In the tasks where impulsivity was assessed, children were not given instructions about whether or not to approach the desirable objects; thus, there were no consequence of acting impulsively. When impulsivity is measured via reported methodologies, it is possible that the items also somewhat reflects situations where acting impulsivity may be viewed as inappropriate (i.e. "Sometimes interrupts others when they are speaking"). By assessing impulsivity when it is not necessarily inappropriate, as was done in the current study with the modified dinky and gift bag tasks, it is possible that the direct relation between impulsivity and AC was diminished. Future work should consider whether the relation of impulsivity to AC depends on the context in which impulsivity is measured.

Nonlinear relations. The findings regarding interactions between impulsivity and either positive affect or EC were only significant in the prediction of GPA, not school adjustment. Rather than school adjustment, impulsivity interacted with EC and positive affect to predict GPA. This may suggest that, for certain children, impulsivity (measured primarily when no consequences for acting impulsively were present) may disrupt learning-related processes (e.g. processing information that is not presented with appetitive stimuli, distractibility while completing school work) rather than social-emotional reactions to the school environment (e.g. peer or teacher relationships). In the current study, EC or positive affect were only significantly related to GPA for children with high impulsivity. This may suggest that more work is needed in order to understand how impulsivity relates to separate dimensions of social-emotional adjustment, rather than academic achievement. In zero-order relations, impulsivity only correlated negatively with class participation rather than school liking variables. It is possible that impulsivity is uniquely related to different aspects of school adjustment, rather than a latent factor comprised of several

dimensions. For example, some work with young children has shown that impulsivity is positively related to SC variables like peer likability (Gomes et al., 2008; Gleason et al., 2005). However, other work has shown that impulsivity is longitudinally related to lower popularity in young children when EC was also in the model (Spinrad et al., 2006). Thus, more work is needed to clarify the unique relation between impulsivity and specific SC-related outcomes, especially as they pertain to school adjustment. The relation of impulsivity to a bifactor model of SC or school adjustment may provide better insight on this question, and should be explored as an avenue for future research.

A novel finding in the current study was the interaction between impulsivity and positive affect predicting children's GPA. Specifically, impulsivity was positively related to GPA when positive affect was high, but it was unrelated to GPA when positive affect was low or average. This may suggest that children who are high on multiple aspects of approach reactivity may be more likely to engage with academic material, and thus are more likely to succeed in school. In this study, both high EC and high positive affect acted as an important factor for highly impulsive children in terms of GPA, indicating that positive affect, in addition to EC, are important factors for highly impulsive children's academic achievement in early elementary school.

These findings may also suggest that latent class analysis, which predicts membership in a latent 'approach reactivity' class from various indicators of the construct, might be a better approach to examine the clustering of approach reactivity dimensions (Degnan et al., 2011). Although impulsivity and positive affect were uncorrelated in zero-order analyses, there could be subtypes of children who were low or high on both dimensions. There was a trend for impulsivity to be negatively related to GPA for children with low positive affect (albeit not significantly); whereas impulsivity was positively related to GPA for children with high positive affect. These different patterns could be better captured by latent class analysis, which would assess whether AC develops differently in children with separate profiles of approach reactivity, rather than an examining an interaction between the continuous dimensions of impulsivity and positive affect, as

was done in the current study. Although previous work has examined latent classes of exuberant children in regard to SC outcomes (Degnan et al., 2011), this has not been examined in relation to AC. The current study lacked the power to conduct such analyses, although this approach should be utilized in future research in relation to AC outcomes.

In the current study, impulsivity and frustration did not interact to predict AC, as was hypothesized and has been found in previous research (in relation to SC; Eisenberg et al., 2004). However, the current study measured both impulsivity and anger with observed variables, and the findings from the 2004 study by Eisenberg and colleagues measured temperament with adults' reports. Anger, as reported by adults on the CBQ, in particular, taps multiple anger-related emotions, rather than just frustration in response to blocked goals. This more specific measure of frustration may not interact with impulsivity in the same way with impulsivity as reported measures of anger. Moreover, no studies have examined whether frustration-related reactions cluster similarly with positive affect and impulsivity in regard to novel or rewarding stimuli. Thus, it is unknown if frustration belongs in a latent class of temperamental approach reactivity, despite theoretical relations between frustration and broad-based approach reactivity constructs (e.g. BAS, surgency, or exuberance; Carver & Harmon-Jones, 2009; Deater-Deckard & Wang, 2012)

As with positive affect, it is possible that latent class analysis of clusters of temperamental approach reactivity dimensions may better capture how different clusters of approach reactivity relates to AC, rather than an interaction between the continuous dimensions, as was modeled in the current study. Future work should examine if frustration reactions in these types of analyses cluster differently in children labeled as exuberant, extraverted/surgent, or high in BAS sensitivity. Certainly, previous work with these broad constructs in young children supports the notion that they are directly related to AC or SC outcomes. However, none of these studies has included frustration in response to blocked goals in their latent profile analyses of temperamental approach reactivity or simultaneously examined the moderating effects of EC with these approach reactivity clusters in relation to AC outcomes. Although this is outside the goal of the current study, work in

this area is needed to clarify whether EC moderates the association between the broad approach-related constructs and AC or SC outcomes, and if frustration in response to blocked goals clusters with other dimensions of approach reactivity in children (i.e. impulsivity and positive affect in response to high-intensity stimuli or novelty).

EC: Important for Some and Not Others

The interactive patterns in the current study suggest that EC was only related to GPA for children with average or high impulsivity or frustration. Alternatively, EC was only related to both AC outcomes for children with low or average positive affect. EC did not relate to AC when children had low impulsivity, low frustration, or high positive affect. In general, children with low frustration and impulsivity had high school adjustment and children with high positive affect had high AC outcomes, regardless of EC. The interaction between EC and frustration or impulsivity in the current study is consistent with results from previous studies indicating that undercontrolled frustration (Diener & Kim, 2004; Eisenberg et al., 2004; Valiente et al., 2010; Valiente et al., 2012) or undercontrolled impulsivity (Valiente et al., 2012) was related to poorer AC or SC outcomes. Thus, the results of the current study and previous work suggest that EC matters the most for children with average or high impulsivity or frustration. The current study also advances previous work by replicating these findings using a factor score of impulsivity calculated from multiple methodologies, rather than just adults' reports of children's impulsivity. In addition, these relations were replicated after controlling for vocabulary, a strong predictor of AC.

A novel finding in the current study was in regard to the interaction between EC and positive affect predicting both AC outcomes. The present study found that EC was positively related to both school adjustment and GPA for children with average or low positive affect; children with high positive affect tended to have high AC outcomes regardless of regulation ability. Given that positive affect directly predicted school adjustment over-and-above the effects of EC, it is interesting that positive affect also qualified the relation of EC to AC. Because positive affect was positively related to AC for children with high impulsivity and children with high positive affect

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tended to have high AC, regardless of EC ability, high levels of positive affect may be a potential resiliency factor for children in regard to AC. In addition, the results of the current study suggest that EC may act as a protective factor for children with low positive affect, who may not experience positive affect in response to rewarding stimuli.   To our knowledge, this is the first study to test this pattern of interaction between EC and positive affect in the prediction of both school adjustment and GPA.

The interactive results for EC and positive affect in relation to AC are in contrast to those in the study by Rydell and colleagues (2003). In that study, regulation of exuberant emotions was only negatively related to externalizing problems for children with high levels of exuberant positive emotions; exuberant regulation was unrelated to externalizing for children with low or average exuberant positive emotion. In other words, Rydell and colleagues (2003) documented a pattern of interaction between EC and exuberant affect such that children with "undercontrolled" exuberant positive affect were most at risk for externalizing problems. This matches the pattern of results that were found regarding EC and either frustration or impulsivity.

There are several possible reasons this discrepancy with the interaction with positive affect may have occurred. First, exuberant positive emotions were reported by parents across scenarios involving a playing a game or winning a contest in the study by Rydell and colleagues; in the current study, positive affect was observed in tasks where the experimenter enthusiastically blew bubbles. It is possible that these types of methodology tap different subtypes of positive affect. In particular, the measurement of positive affect in this study may be more related to exuberant positive emotions in situations with unfamiliar adults; whereas parent-reported measures of exuberant positive emotions may also tap positive affect in a wider variety of situations (e.g. in setting to which the child is more familiar, such as the home). This notion is supported by the lack of correlation between positive and other dimensions of approach reactivity in the current study (i.e. frustration and impulsivity), as well as the different pattern of interaction with EC, compared to that which was found regarding impulsivity or frustration.   Moreover,

although Kochanska and colleagues (2007) found that a positive affect composite that included the bubbles task was negatively related to self-regulation, it is possible that the bubbles task in-and-of-itself does not relate strongly to the broad-based approach reactivity construct. It is likely a latent factor of positive affect capturing multiple expressions of positive affect in reguard to rewarding or novel stimuli might better represent positive affect in relation to temperamental approach reactivity than simply positive affect during the bubbles tasks. Moreover, it is also possible that the specific ability to regulate exuberant behaviros, as measured in Rydell's study, differs from general EC ability, as was measured in the current study. It is possible that children are more adept at regulated specific types of emotions or behaviors, or are more or less likely to delploy regulatory skills in a given context, depending on individual goals or motivation.

In addition to different measurement in positive affect and regulation between the two studies, another potential reason there were discrepancies in the findings was that the outcome in the study by Rydell and colleagues was problem behaviors; whereas, the current study mainly measured positive school adjustment outcomes (participation in class and school liking). The only variable that captured poor school adjustment (school avoidance) was reversed and averaged with school liking. Thus, it is possible that our latent variable of school adjustment did not capture enough of the variability at the low end of the school adjustment dimension to replicate the interactive pattern found in Rydell and colleagues' 2003 paper. It is also possible that externalizing problems is too different from school adjustment to compare prediction of these outcomes from the interactive patterns obtained in these two studies. Future research should focus on specific outcomes to clarify this association between EC and positive affect regarding a variety of AC and SC outcomes.

Avenues for Future Research

One largely unexplored area in the current study is the extent to which sex moderates the main effects of temperament to AC. In zero-order correlations, frustration was positively related to GPA for girls, but it was unrelated to GPA for boys. In contrast, EC was more strongly related

to GPA for boys than for girls. Although no sex differences were found in the multiple-group

models for boys and girls, only partial measurement invariance of the school adjustment factor

was found across sex. This could have diminished our capacity to find significant differences in

the relation between temperament and school adjustment, because differences in measurement

structure can affect regression coefficients in SEM models (Milsap, 1997). This supports the

notion that future research may benefit from a analysis of how temperament relates to specific

aspects of school adjustment, rather than a latent construct. It is possible that temperamental

approach reactivity (particularly impulsivity, given the findings of the current study) may relate

differently to these outcomes for boy and girls. Future research should explore this possibility

using more specific indices of school adjustment and academic achievement.

Future work is also needed in order to clarify the developmental relations between early

emotional approach reactivity and subsequent EC development in relation to later AC. It is

possible that the relation between early approach reactivity and AC is mediated by individual

differences in the development in EC, such that early positive affect or frustration in toddlerhood

or infancy predicts EC growth trajectories in during early childhood, which in turn predicts AC in

early elementary school. This hypothesis is supported by temperamental theory which suggests

that early approach reactivity may constrain later EC development (Rothbart et al., 2006) and

empirical work that suggests that earlier EC is associated is more regulated anger and joy in

toddlerhood (Kochanska et al., 2000). Given the findings of the current study, future work should

also include EC in the same model as approach reactivity when predicting AC. In correlation and

CFA analyses, impulsivity was negatively related to AC outcomes. However, when it was

included in a path analysis model with other approach reactivity variables and EC, positive affect

and EC were the only unique predictors of AC. Thus, although impulsivity may relate to AC in

zero-order correlations, the findings of the current study underscore the importance of including

potential confounding temperament variables in the analysis. Studying impulsivity in this manner

may clarify the mixed findings regarding impulsivity and AC in the literature

Strengths and Limitations

A strength of the current study is the assessment of EC and impulsivity across multiple measurement contexts and with multiple reporters. Measuring EC and impulsivity in this way decreased the correlation between these normally highly correlated temperamental constructs, allowing them to be simultaneously entered as predictors in the same model without experiencing problems of multicolinearity. Although utilizing observed and reported methods to assess impulsivity and EC was a strength of the current study, using only observed data for emotionality was more problematic and could be considered a weakness because validity of these constructs could not be assessed. Future work should examine whether emotional reactivity assessed in these contexts is related to any of the broad-based approach reactivity constructs, such as exuberance, BAS, or surgency. Work in this area could further clarify the findings of the current study.

A weakness of the current study was the lack of external measures to verify that positive affect, frustration, and impulsivity tapped the more broad-based approach reactivity constructs of BAS, surgency, or exuberance. It was surprising that neither positive emotion nor frustration was correlated with impulsivity. Indeed, positive emotion was positively correlated with EC, and neither positive affect nor frustration was positively correlated with impulsivity in the current study. This could be because the assessments designed to tap emotional reactivity did not adequately tap the constructs as was hypothesized in the current study, although they are widely used in developmental studies. A latent factor comprised of multiple assessments of these emotions would help establish construct validity and clarify the findings of the current study. In addition, the patterns in the current sample may not be representative of a more general population because the majority of participants were from middle class families. Although SES was included in the model to control for attrition in our sample, the rate of attrition in the sample could bias the results

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of the current study. Finally, the modest sample size in the current study may have precluded the detection of significant interactive patterns.

Despite some limitations, this study was the first to examine the fine-tuned relations of these temperamental dimensions in the same study in order to compare unique and interactive effects on AC outcomes. In addition, this is the only study to have included both observed and reported measures of impulsivity in a latent construct in models predicting AC, and this was the first study to examine interactions between impulsivity and positive affect in the prediction of AC. Advancing work in this area could lead to breakthroughs in how to channel children's approach reactivity in appropriate ways that could lead to academic and social success in early childhood.

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Table 1

Descriptives of Study Variables

Emotion	N	Mean	SD	Range	Skew	Kurtosis
Bubbles Positive	192	2.36	0.53	2.58	-0.58	-0.02
Locked Box Frustration 54m	167	1.43	0.34	1.50	1.05	0.67
Impulsivity						
CBQ Impulsivity	215	4.59	0.57	3.08	-0.33	0.11
Mod. Dinky Toys 54m	166	-20.33	12.76	29.00	0.64	-1.53
Mod. Gift Bag 42m	190	-19.73	12.70	29.00	0.53	-1.64
Mod. Gift Bag 54m	168	-75.10	6.16	17.62	1.68	0.99
EC						
Bird/Dragon	192	9.33	3.47	12.43	0.23	-0.61
CBR	193	3.61	0.68	3.63	-0.99	0.85
Gift Wrap/Waiting for Bow	194	0.00	0.85	3.81	-0.55	-0.32
Snack Delay	192	3.38	0.93	3.00	-1.38	0.80
Academic Competence						
Child SLAQ 72m	143	2.47	0.45	1.78	-0.76	-0.16
Adult SLAQ	166	4.31	0.36	2.24	-1.64	3.94
Participation	159	1.52	0.43	1.82	-0.80	-0.16
GPA	159	7.45	2.28	9.00	-1.04	0.18
Covariates						
Vocabulary	168	11.14	3.11	14.00	-0.04	-0.82
SES	232	-0.01	0.85	4.01	-0.13	-0.70

Note: Observed impulsivity variables were reverse code so that high scores indicated high impulsivity.

Table 2

Correlations among temperament variables and covariates

	Impulsivity					EC				Covariates		
	2	3	4	5	6	7	8	9	10	11	12	13
1. Frustration	-0.05	0.22 **	0.05	0.00	0.06	0.13 †	0.16 *	0.09	0.06	0.13 †	0.04	-0.13
2. Bubbles Positive		0.05	0.02	0.02	-0.04	-0.02	0.23 **	0.18 **	0.14 *	0.06	0.01	0.18 *
3. CBQ Impuls			0.16 *	0.16 *	0.17 *	-0.12	-0.07	-0.17 *	-0.19 **	-0.22 **	-0.16 *	-0.08
4. Mod. Dinky 54m				0.22 **	0.23 **	-0.04	-0.06	-0.15 †	-0.12	-0.19 **	-0.22 **	-0.15 *
5. Mod. Gift 42m					0.20 *	0.01	-0.18 **	-0.19 **	-0.27 **	-0.25 **	-0.21 **	-0.13 †
6. Mod. Gift 54m						-0.04	-0.06	-0.17 *	-0.23 **	-0.11	-0.11	-0.15 *
7. Snack Delay							0.23 **	0.33 **	0.37 **	0.18 **	0.07	0.25 **
8. Bird/Dragon								0.51 **	0.41 **	0.40 **	0.32 **	0.10
9. CBR									0.63 **	0.39 **	0.25 **	0.20 **
10. Gift Wrap/Bow										0.41 **	0.25 **	0.25 **
11. Vocabulary											0.42 **	0.08
12. SES												-0.10
13. Sex												

** $p < .01$; * $p < .05$; + $p < .10$
Note: Observed impulsivity variables were reverse coded so high scores reflect high impulsivity

Table 3

Correlations among Outcome Variables and Covariates

	Academic Competence			Covariates		
	2	3	4	5	6	7
1. Child SLAQ	0.40 **	0.29 **	0.22 **	0.10	0.19 *	0.06
2. Adult SLAQ		0.48 **	0.34 **	0.21 **	0.15 *	0.25 **
3. Participation			0.63 **	0.39 **	0.19 **	0.33 **
4. GPA				0.50 **	0.26 **	0.10
5. Vocabulary					0.40 **	0.10
6. SES						-0.10
7. Sex						

$** p < .01; * p < .05; + p < .10$
Note: Observed impulsivity variables were reverse coded so high scores reflect high impulsivity

Table 4

*Correlations between Temperament and AC*

Temperament Variable	School Adjustment			
	Participation	Adult SLAQ	Child SLAQ	GPA
1. Frustration	-0.01	0.02	0.12	0.11
2. Bubbles Average	0.22 **	0.18 *	-0.03	0.07
3. Impulsivity Factor Score	-0.27 **	-0.12	-0.01	-0.17 *
3a. Mod. Gift 42m	-0.12	-0.09	-0.01	-0.08
3b. Mod. Gift 54	-0.21 *	-0.16 †	-0.09	-0.14
3c. Mod. Dinky 54	-0.14	-0.04	-0.07	-0.11
3d. CBQ Impulsivity	-0.29 **	-0.11	-0.05	-0.16 *
4. EC Factor Score	0.41 **	0.30 **	0.30 **	0.39 **
4a. CBR	0.37 **	0.23 **	0.31 **	0.37 **
4b. Bird/Dragon	0.41 **	0.23 **	0.26 **	0.25 **
4c. Gift Wrap/Bow	0.37 **	0.37 **	0.31 **	0.31 **
4d. Snack Delay	0.26 **	0.15 †	0.27 **	0.14 †

** $p < .01$; * $p < .05$; + $p < .10$
Note: Observed impulsivity variables were reverse coded so high scores reflect high impulsivity

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Table 5

Fit Indices for AC Models

	N	χ^2	DF	P	$\chi^2\Delta$	DF Δ	P Δ	RMSEA	SRMR	CFI
1. Measurement Invariance										
A. Sex Unconstrained	255	24.06	26					0.00	0.04	1.00
Model Boys	141	14.36								
Model Girls	114	9.70								
B. Loadings	255	25.62	28		1.56	2		0.00	0.07	1.00
C. Intercepts	255	54.60	31 *		28.98	3 **		0.08	0.13	0.85
D. Intercepts not Participation	255	37.79	30		12.17	2 **		0.05	0.11	0.95
E. Intercepts not Participation or Adult SLAQ	255	26.06	29		0.44	1		0.00	0.07	1.00
2. Structural Invariance	255	39.35	41		13.28	12		0.00	0.10	1.00
3. Direct Effects with Sex as a Covariate										
A. Without EC in Model	255	14.25	14					0.01	0.03	1.00
B. With EC in Model	255	22.09	16					0.04	0.04	0.98
4. Quadratic effects										
A. Quadratic Effects with EC										
i. Quadratic Impulsivity	255	24.06	18					0.04	0.04	0.98
ii. Quadratic Positive	255	23.31	18					0.03	0.04	0.98
B. Quadratic Effects without EC										
i. Quadratic Impulsivity	255	14.32	16					0.00	0.03	1.00
ii. Quadratic Positive	255	15.22	16					0.00	0.03	1.00
5. Interactions between EC and Reactivity										
A. EC X Pos	255	22.93	18					0.03	0.04	0.99
B. EC x Anger	255	24.25	18					0.04	0.04	0.98
C. EC x Impulsivity	255	21.89	18					0.03	0.04	0.99
6. Interactions between Impulsivity and Emotion										
A. Impulsivity x Pos	255	23.29	18					0.03	0.04	0.98
B. Impulsivity x Anger	255	24.59	18					0.04	0.04	0.98

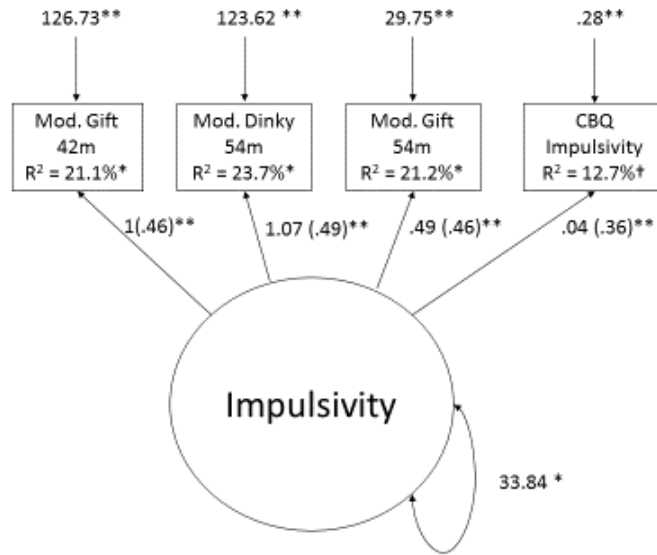** $p < .01$; * $p < .05$; + $p < .10$

Figure 1

Three Factor CFA.
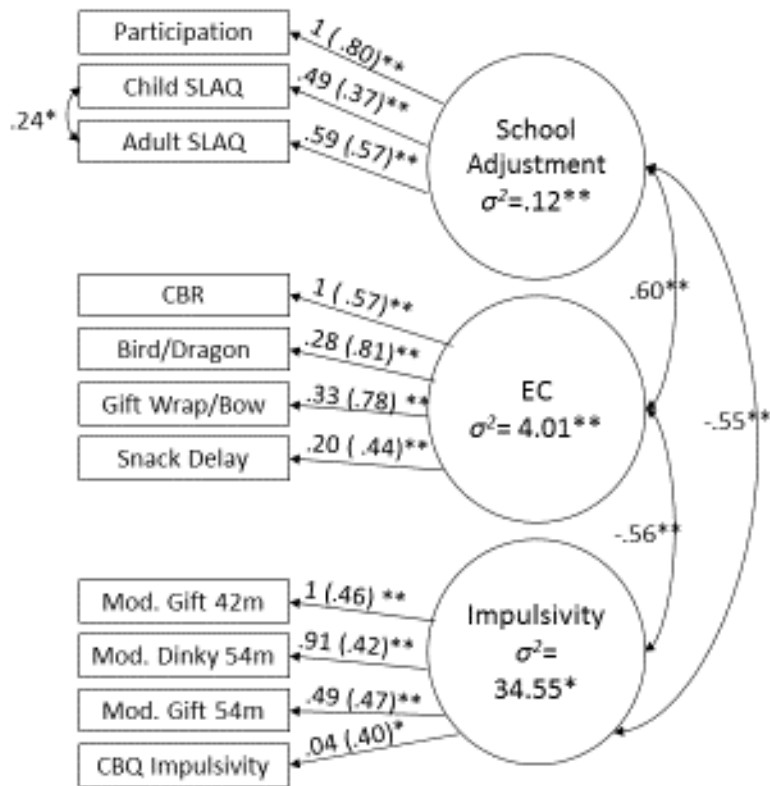
** *p* < .01; * *p* < .05; + *p* < .10

Note: *N* = 215; Model Fit: $X^2(40)$ = 43.26, *p* = *ns*; RMSEA = .02 (*p* < .05 = .93); CFI* = 1.00; SRMR = .05; loadings are unstandardized (standardized); covariances are standardized
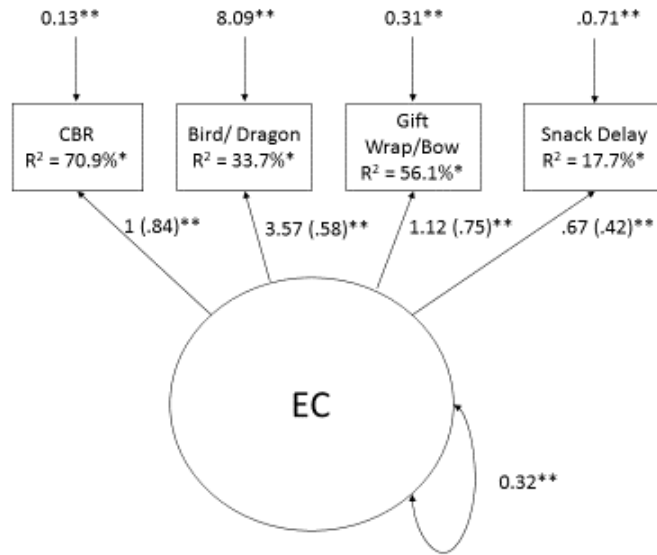
Figure 2

Impulsivity CFA.

** $p < .01$; * $p < .05$; + $p < .10$

Note: $N = 215$; Model Fit: $X^2(2) = 0.10$, $p = ns$; RMSEA = .00 ($p < .05 = .97$); CFI* = 1.00; SRMR = .01; unstandardized parameters (standardized parameters); the variance of the latent factor is represented by the semi-circle arrow

Figure 3

EC CFA.

** *p* < .01; * *p* < .05; + *p* < .10

Note*: N* = 194; Model Fit: X^2 (2) = 3.08, *p* = *ns*; RMSEA = .05 (*p* < .05 = .37); CFI = .99; SRMR = .02; unstandardized parameters (standardized parameters); the variance of the latent factor is represented by the semi-circle arrow

Figure 4

Direct Effects Model of Temperament on AC Outcomes without EC in the Model.
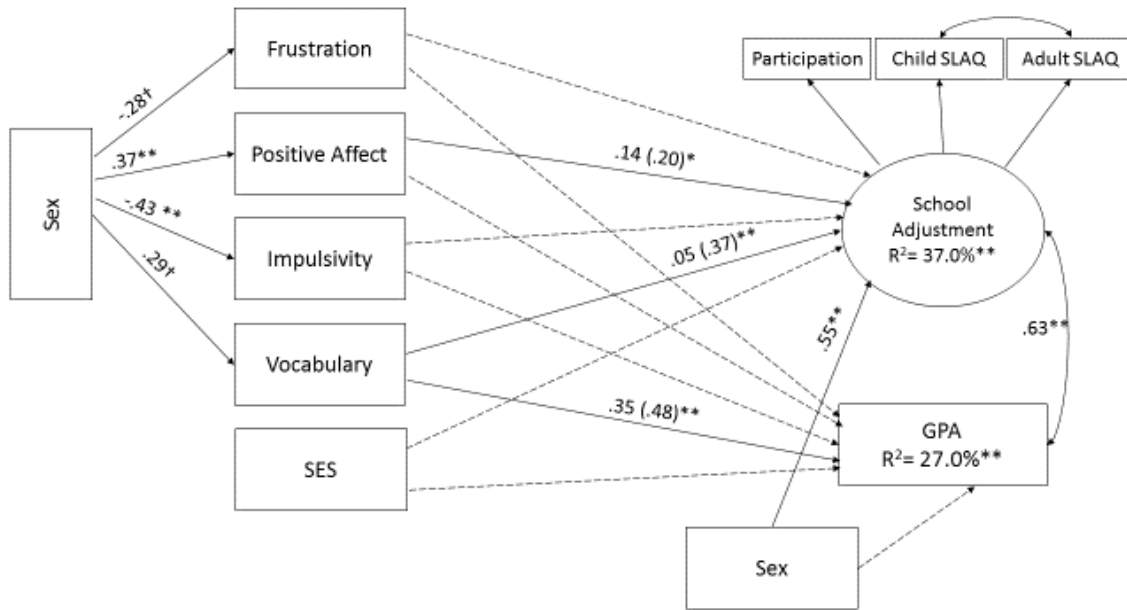
** *p* < .01; * *p* < .05; + *p* < .10
Note: *N* = 255; Model Fit: X^2(14) = 14.25, *p* = *ns*; RMSEA = .01 (*p* < .05 = .87); CFI = 1.00; SRMR = .03; parameters are standardized (unstandardized); coefficients for paths from sex to other variables are standardized by the dependent variable; covariances are standardized; R^2 values were multiplied by 100 to represent the percentage of variability in the dependent variable explained by the model

Figure 5

Direct Effects Model of Temperament on AC Outcomes with EC in the Model.
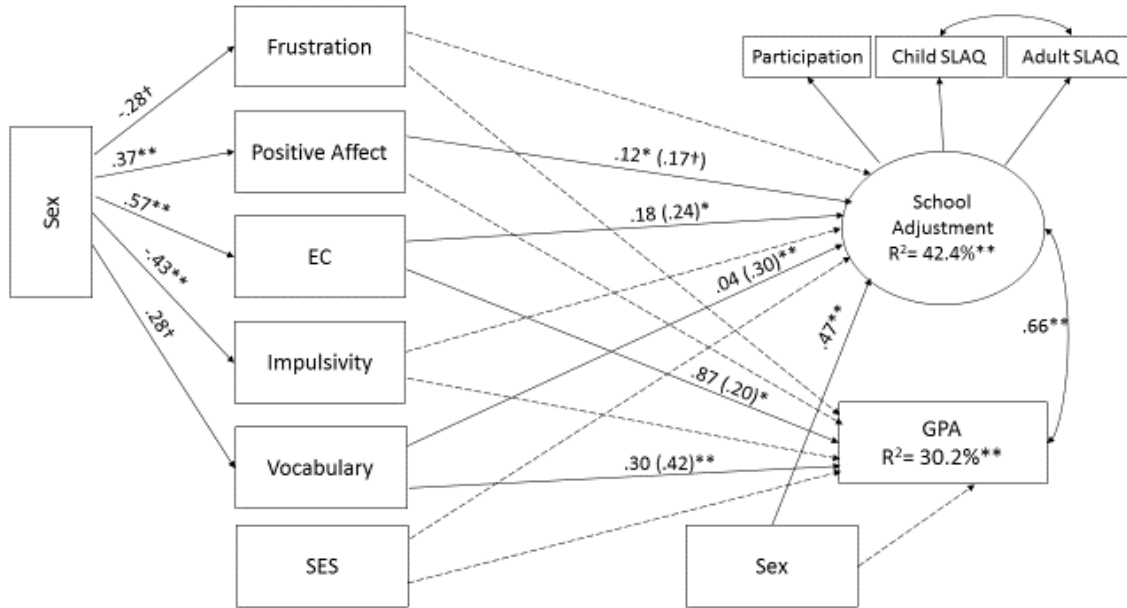
** *p* < .01; * *p* < .05; + *p* < .10

Note: *N* = 255; Model Fit: X^2(16) = 22.09, *p* = *ns*; RMSEA = .04 (*p* < .05 = .66); CFI = .98; SRMR = .04; parameters are standardized (unstandardized); coefficients for paths from sex to other variables are standardized by the dependent variable; coefficients for covariances are standardized; R^2 values were multiplied by 100 to represent the percentage of variability in the dependent variable explained by the model

Figures 6a and 6b.
The Interaction between EC and Positive Affect in the Prediction of School Adjustment and GPA.
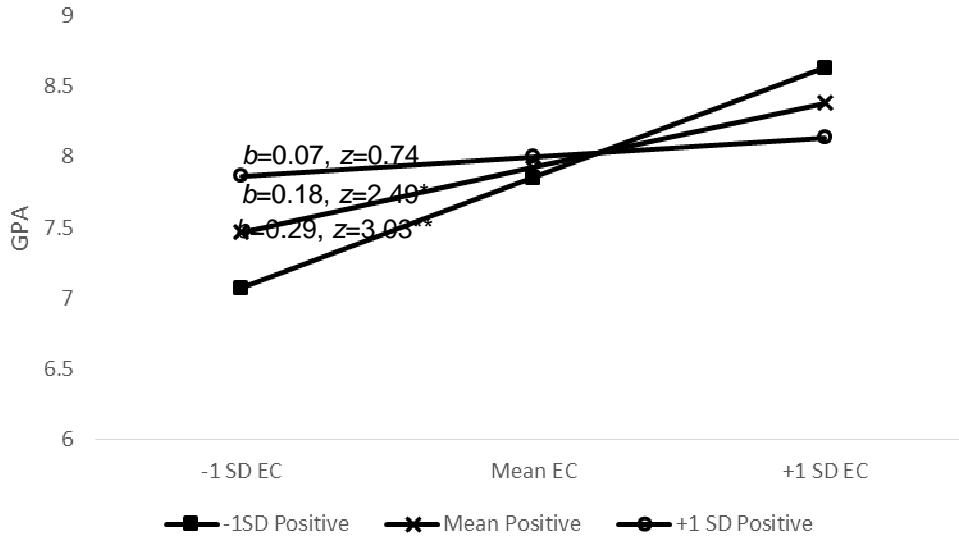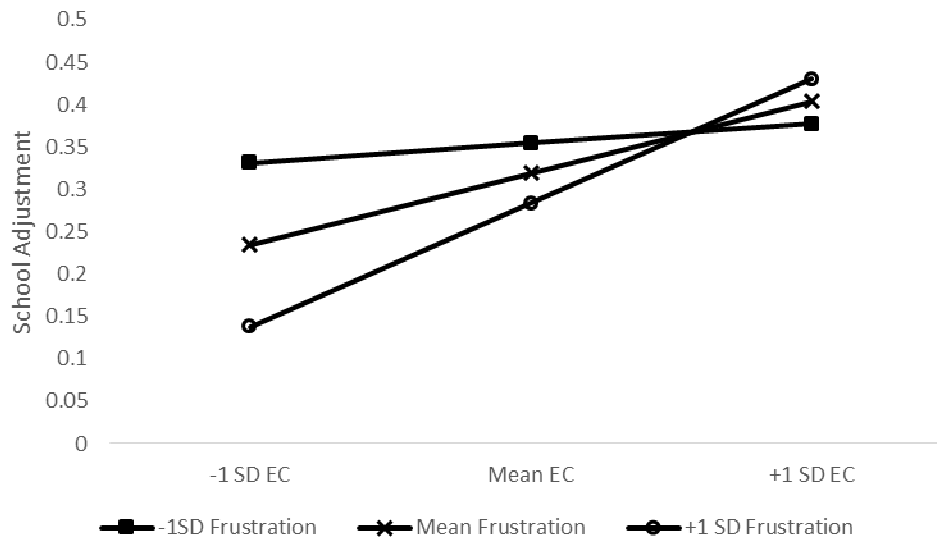
Figure 6a. School Adjustment
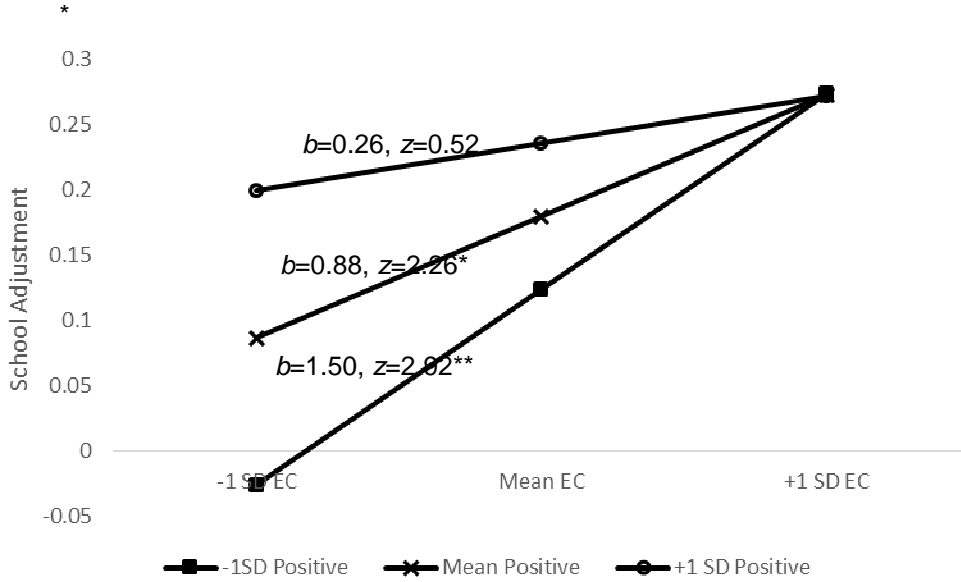
Figure 6b. GPA

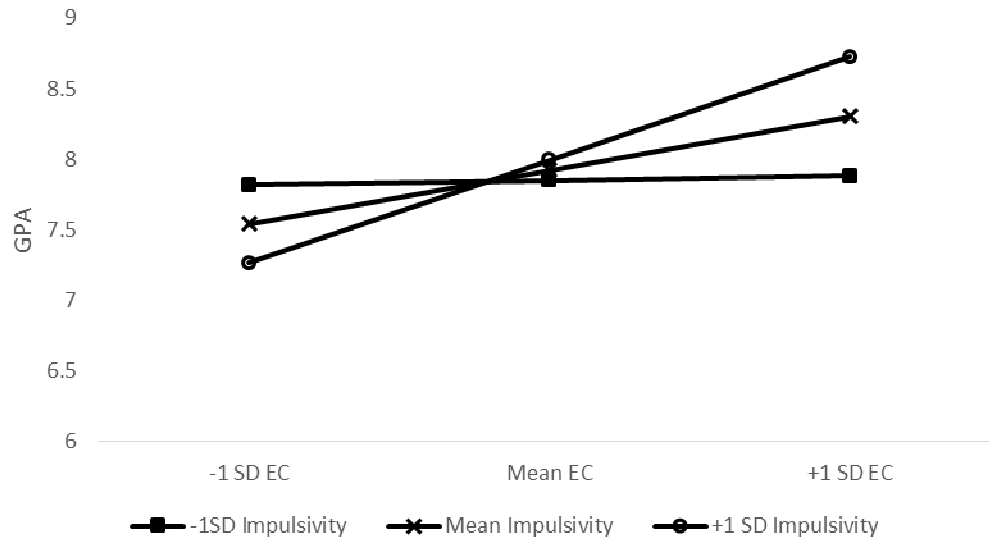Note: Significant simple slopes are denoted as ** $p < .01$; * $p < .05$; + $p < .10$

Figure 7

The Interaction between EC and Frustration Predicting School Adjustment.

Note: Significant simple slopes are denoted as ** *p* < .01; * *p* < .05; + *p* < .10
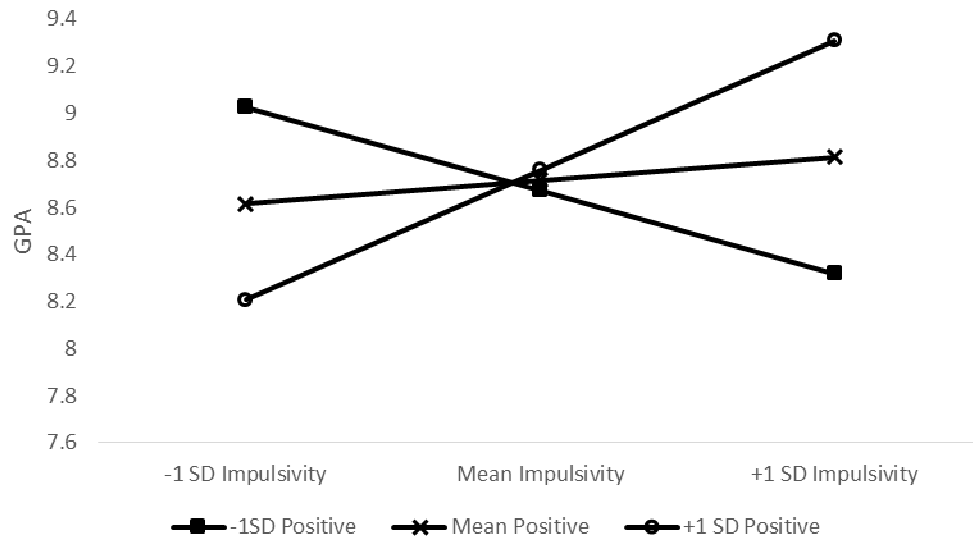
Figure 8

The Interaction between EC and Impulsivity Predicting GPA.

Note: Significant simple slopes are denoted as ** p < .01; * p < .05; + p < .10

Figure 9

The Interaction between Impulsivity and Positive Affect Predicting GPA.

Note: Significant simple slopes are denoted as ** $p < .01$; * $p < .05$; + $p < .10$