LINKING EARLY SELF-REGULATION TO POSITIVE FUNCTIONING IN ADOLESCENCE

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Recent research has documented that high self-regulation in early childhood is associated with greater academic performance and more adaptive social skills, particularly in early or middle childhood. There has been far less work examining longitudinal associations between early childhood self-regulation and adolescent functioning. In addition, few studies have examined the development of self-regulation from a person-centered analytic perspective, such as grouping children into homogenous trajectory groups, and then linking group membership to adolescent outcomes. Finally, the mechanisms that drive the pathways between childhood behaviors and adolescent functioning have been relatively underexplored. The current dissertation, therefore, adds to the extant literature by exploring the association between structured assessments of early childhood self-regulation and self-reports of academic engagement and motivation, romantic relationship quality, and workplace behaviors in adolescence. Teacher-child and parent-child relationship quality in middle childhood were examined as potential mediators of these associations, and the parent-child relationship in early childhood was treated as a potential moderator. Self-regulation trajectory groups (as reported by teachers throughout early and middle childhood) were also examined in relation to these adolescent outcomes.

Research questions were examined using two U.S. samples, the NICHD Study of Early Child Care and Youth Development (SECCYD; $N = 1364$) and the Pitt Mother and Child Project (PMCP; $N = 314$). Across both samples, assessments of early childhood self-regulation did not

predict adolescent outcomes. Furthermore, the teacher-child and parent-child relationship did not mediate or moderate these associations. However, common self-regulation trajectory groups were identified across datasets, including a *High Stable* and a *Low Curvilinear* group (self-regulation decreased to age 9 and then steadily increased to age 12). Three additional groups emerged: for the SECCYD a *Medium Increasing* and a *Medium Decreasing* group; and for the PMCP a *Medium Stable* group.

Self-regulation trajectory group membership was predicted by demographic characteristics, with higher or improving groups generally comprised of White, higher income youth, and girls, and lower or declining groups more likely to include African American, lower income youth, and boys. In addition, the *Medium Decreasing* group reported lower romantic relationship quality relative to *High Stable* and *Medium Increasing*. Implications for practice are discussed.

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PREFACE

It has been a long road to get to this point, but I never would have been able to make it without the contributions of the amazing people around me. I am lucky to be surrounded by such a supportive group of people who helped me throughout this extensive process. I thank my committee and my colleagues at Pitt who helped shape my experiences as a professional in this field. I thank my friends who have always lent a sympathetic ear. Most of all I thank my family: my Mother and Father, Sarah and Jeffrey, and of course the newest addition to the family, my nephew Henry, who sent me my good luck flowers. You supported me every step of the way and have always been there for me. For that I will always be grateful.

1.0   INTRODUCTION

Research on self-regulation over the past several decades reflects a growing emphasis on the importance of these behavioral and cognitive skills for successfully adapting, navigating, and coping during important developmental transitions throughout the lifespan (McClelland, Ponitz, Messersmith, & Tominey, in press). Presently, researchers have increased their focus on examining self-regulation during early childhood to demonstrate the impact that early patterns of behavior have on concurrent and subsequent levels of functioning (Raver, 2002). There are three main justifications for focusing on skill-building during early childhood: (1) self-regulation during early childhood is associated with a number of widely used indicators of positive functioning in both the cognitive domain (e.g., academic skills; Blair & Razza, 2007) and the social/behavioral domain (e.g., behavior problems; Murray & Kochanska, 2002); (2) cost-benefit analyses of interventions targeting preschool-aged children have demonstrated reductions in a number of behaviors that prove costly to the public (e.g., teenage pregnancies, welfare assistance, incarceration; Belfield, Nores, Barnett, & Schweinhart, 2006); and (3) self-regulation skills are modifiable (Raver et al., 2011). These justifications lend support for the importance of funding programs that aim to improve self-regulation skills prior to school entry, an endeavor that researchers are currently undertaking (Raver, 2002).

Most research on the benefits of self-regulation in early childhood does not include outcomes past elementary school, focusing almost exclusively on academic achievement and

behavioral problems in the context of the elementary school environment. However, a number of researchers have begun to explore whether these early skills may actually have lasting impacts on a range of social behaviors well beyond childhood. Early childhood self-regulation, for example, has been found to predict several domains of adult functioning including physical health, financial status, criminality, and single-parenthood status (e.g., Moffitt et al., 2011). Given the foreshadowing of long-term benefits that may be derived from adaptive self-regulation skills, more research is needed that addresses behavioral outcomes both within and outside of the school context and beyond the elementary school years.

In addition, few studies have examined individual variability in self-regulation trajectories throughout the school years, or attempted to identify factors that may contribute to these continuities, improvements, or declines in functioning (Caspi, 2000). The present study will explore the association between early childhood self-regulation and various indicators of positive functioning in middle (age 15) to late (age 20) adolescence, including academic engagement and motivation, romantic relationship quality, and workplace behaviors. Group-based trajectory modeling will also be used to track developmental patterns in self-regulation from early childhood through early adolescence, and group membership will subsequently be used to predict positive functioning through middle to late adolescence.

Although some studies have examined the association between childhood self-regulation and social outcomes into adolescence and early adulthood (e.g., Caspi, 2000; Moffitt et al., 2011), there has been little exploration of the mechanisms that may drive these associations. In addition, there is little theoretical or empirical work to illuminate how these early behaviors may affect later outcomes. Given the transactional nature of interpersonal relationships, and the powerful impact that they have on children's development, dyadic relationships with important

adults may drive the associations between self-regulation and adolescent outcomes. Therefore, the teacher-child and parent-child relationship in middle childhood will be examined as potential mediators of the links between early childhood self-regulation and adolescent academic engagement, romantic relationship quality, and work behaviors. Additionally, given that the relationship dynamic between parents and children in early childhood sets the tone for subsequent interactions in middle childhood, the association between self-regulation and adolescent outcomes may depend upon different levels of parent-child relationship warmth and conflict. Therefore, parent-child relationship quality in early childhood will also be examined as a moderator of the association between early childhood self-regulation and adolescent functioning.

The framework for the hypothesized pathways from early childhood self-regulation to adolescent academic engagement, romantic relationship quality, and workplace behaviors is illustrated in Figure 1.

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Early Childhood	**A**	**Middle Childhood**	**B**	**Adolescence**
Self-Regulation		Parent-Child Relationship Quality Teacher-Child Relationship Quality		Academic Engagement Romantic Relationship Quality Workplace Behaviors
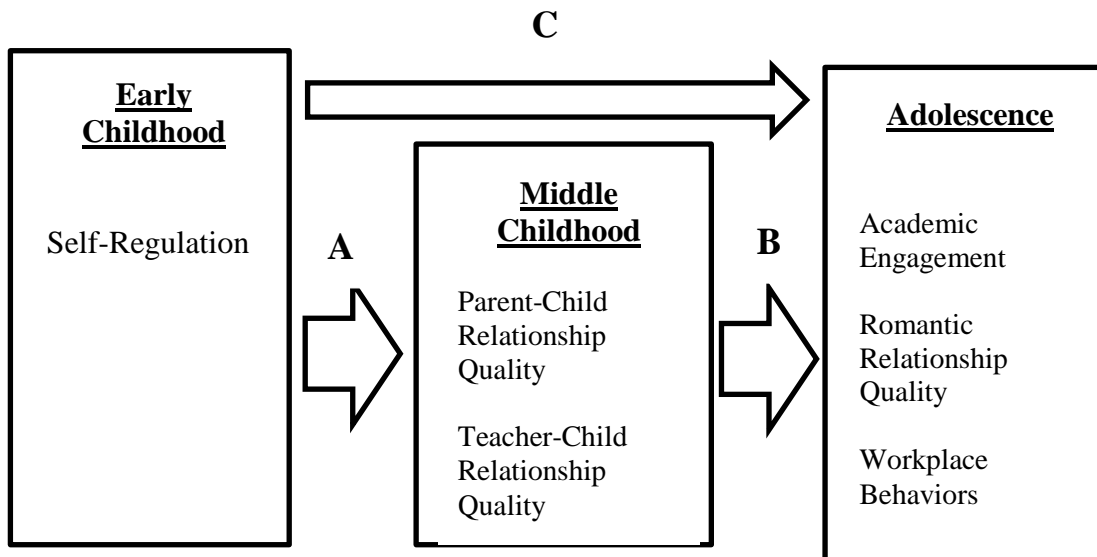
Figure 1: Conceptual Model for Parent-Child and Teacher-Child Relationship Quality Mediating the Association between Early Childhood Self-Regulation and Adolescent Behaviors

Pathway C models the direct effect between early childhood self-regulation and adolescent academic engagement, romantic relationship quality, and workplace behaviors. Pathways A and B illustrate the indirect effects of this association through the mediators, parent-child and teacher-child relationship quality. Specifically, early childhood self-regulation is expected to predict adult-child relationship quality in middle childhood (Pathway A) and adult-child relationship quality is expected to predict adolescent outcomes (Pathway B).

The conceptual framework for the group-based trajectory analyses are provided by Figure 2. Pathway 1 shows that child and family characteristics (gender, race/ethnicity, household income, and maternal education) are expected to differentially predict self-regulation trajectory group membership. Self-regulation trajectory group membership is also hypothesized to predict adolescent academic engagement, romantic relationship quality, and workplace behaviors, which is represented by Pathway 2.

Early Childhood

Child Gender

Child Race/Ethnicity

Household Income

Maternal Education

1

Middle Childhood

Self-Regulation Trajectory Group

2

Adolescence

Academic Engagement

Romantic Relationship Quality

Workplace Behaviors
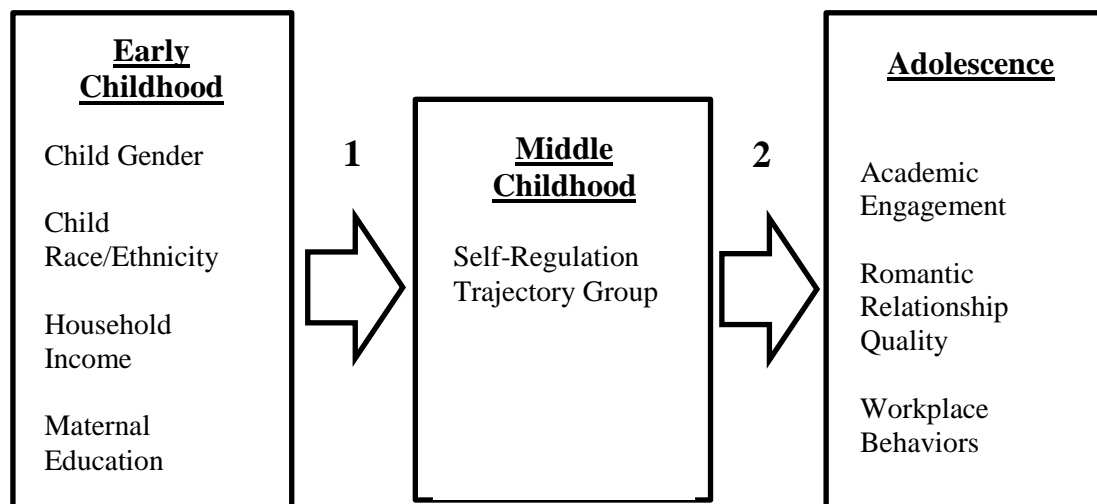
Figure 2: Conceptual Model for Self-Regulation Trajectory Group Analyses

All research questions will be examined in two comparable longitudinal U.S. datasets, both of which utilize a 1991 birth cohort. One dataset features a predominantly middle class sample and the other a sample of low-income boys, providing a comparison in developmental trends and pathways for children from varying SES backgrounds. These analyses are essential given that residence in a low-income household is associated with a greater risk of developing self-regulation difficulties (Evans & Rosenbaum, 2008; Raver, 2004; Qi & Kaiser, 2003), and that disadvantaged groups are most often the targets of intensive early childhood interventions, yet tend to be understudied.

2.0   REVIEW OF THE LITERATURE

2.1   SELF-REGULATION

Self-regulation refers to a complex array of skills deliberately employed to monitor and regulate thought and behavior in response to a challenging situation, and to suppress strong emotional drives or impulses in favor of more constructive, but less gratifying responses (Rimm-Kaufman & Wanless, 2011). Although the manner in which researchers define, operationalize, and measure self-regulation may vary (McClelland, Geldhof, Cameron, & Wanless, 2013), there is a general consensus in the literature that self-regulation comprises two distinguishable skill sets: the cognitive or "cool" self-regulatory processes and the affective or "hot" regulatory processes (Blair, Zelazo, & Greenberg, 2005). Cognitive self-regulation is typically referred to as executive functioning (attention, working memory, and behavioral inhibition), which is involved in problem-solving, use of memorization strategies, and automatic response inhibition (Miyake, Friedman, Emerson, Witzki, & Howerter, 2000). Emotional regulation comprises "hot" aspects of self-regulation, which includes the temperamental dimension of effortful control (Eisenberg et al., 2004).

Effortful control is distinguished from executive functioning by the nature of the stimulus presented to the individual. Individuals typically rely on executive functioning when presented with neutrally affective tasks and stimuli. Effortful control, on the other hand, involves

suppressing a dominant response in favor of a subdominant one when faced with an unpleasant or attractive stimulus (Blair & Razza, 2007), which is sometimes referred to as delay of gratification (Li-Grining, 2007; Mischel, Shoda, & Rodriquez, 1989). Additionally, there is evidence that different areas of the brain are activated for tasks involving the use of effortful control (e.g., emotion-centered areas such as the limbic system) and executive functioning (e.g., prefrontal cortex; Lewis & Todd, 2007). Although both skill sets are important predictors of positive functioning, research seems to indicate that the emotional aspects of self-regulation are crucial to the organization, management, and guidance of the cognitive aspects; an emotion-cognition connection which is surmised to be especially relevant during the early childhood years as the limbic system and frontal lobes undergo rapid development (Blair, 2002).

The current paper will focus predominantly on two types of self-regulation: structured delay of gratification tasks which tap into the affective process of effortful control, and teacher reports of general self-regulatory behaviors in the classroom context, which have been defined in past literature as classroom behavioral regulation (Wanless et al., 2013b). Both constructs are related as teacher reports of behavioral regulation often include items that tap into a child's ability to regulate emotions, which are deliberately taxed and measured during delay of gratification tasks. However, classroom behavioral regulation measures a broader range of regulatory behaviors in the classroom context, which makes it misleading to define these assessments as pure measures of emotional regulation in the same manner as a delay of gratification task. Therefore, for simplicity sake, the more general term *self-regulation* will be used throughout the paper to describe both types of assessments and will focus on how early patterns of self-regulatory behavior may reliably predict subsequent functioning in middle and late adolescence.

2.1.1 Stability and change in self-regulation

Recently, a number of studies have attempted to document the development of self-regulation during the early childhood years. However, far less research is known about how self-regulation develops from early childhood through adolescence. A few studies, for example, have sought to describe the development of self-regulation in the first four years of life by focusing on changes (improvement) or stability (rank-order) over time (e.g., Kochanska, Coy, & Murray, 2001; Kochanska, Murray, & Harlan, 2000; Li-Grining, 2007). They found that self-regulation improves steadily over the first four years, while maintaining relative stability in differences between individuals. While these studies have provided a great deal of insight into self-regulation development over time, they contain similar theoretical and methodological limitations. Self-regulation was only assessed prior to age four, implying that these skills do not change much after the preschool years. Additionally given that most of these studies only considered two time points for measuring self-regulation, mean differences between earlier and later assessments were used to demonstrate that children were improving over time, and correlations were used to establish rank-order stability. Reliance on two time points to model patterns of change or stability assumes a linear trajectory in development, which may not truly represent the pattern of development for all children (Adolf, Robinson, Young, and Gill-Alvarez, 2008; Nagin, 2005). In addition, examining mean differences washes out any individual differences in growth trajectories, painting a picture that all children improve linearly when in fact some may improve at different rates, some may decline at different rates, while others may remain relatively stable. Furthermore, past studies did not make use of many control variables, which creates potential endogeneity biases (Duncan, Magnuson, & Ludwig, 2004; NICHD Early Child Care Research Network (ECCRN) & Duncan, 2003).

Interest in examining change and stability in self-regulation is further bolstered by the work of researchers such as Adolf and colleagues (e.g., Adolf et al., 2008) who stressed that longitudinal studies are often plagued by numerous methodological limitations. These limitations would include reliance on few time points collected at arbitrary intervals and assumptions of linear trajectories. Increasing the number of time points can provide a more accurate picture of the unique developmental pathways unfolding over time, an endeavor which few researchers have attempted with standardized assessments of self-regulation. This point was addressed by Hay and Forrest (2006), who pointed out that theories of self-control, a related dimension, often address how these skills develop and unfold over time without providing empirical evidence as support. Their prime example was a theory proposed by Gottfredson and Hirschi (1990), which suggests that low self-control is a leading cause of acts that violate laws governing social order (most notably criminal or delinquent behaviors), and stressed that self-control develops early in life and remains relatively stable throughout adolescence. One study tested portions of this theory by examining individual changes (growth, declines, or stability) and relative stability (rank-order relative to peers) in self-regulation using latent growth modeling and data from the NICHD Study of Early Child Care and Youth Development (SECCYD) (Vazsonyi & Huang, 2010). Parent reports showed that self-regulation increased steadily from ages 4.5 to 10.5, with moderate to high stability in individual differences across all three time points. Similarly, latent growth analysis was also used to examine the development of self-regulation in early childhood from ages two to four years, and found steady positive growth in these abilities over time (Moilanen, Shaw, Dishion, Gardner, & Wilson, 2010).

Although these studies are unique in examining both intercept and slope data for the development of self-regulation over multiple time points, the analyses still relied on population

averages and modeled linear growth, methods that cannot address the potential of identifying individual differences in trajectories. A potential alternative for assessing the development of self-regulation over time is the use of person-centered analytic techniques, such as group-based trajectory analyses using semiparametric modeling procedures to account for individual differences in developmental trajectories (Nagin, 2005). Person-centered approaches assume heterogeneity within the population, such that individuals may be classified into groups based on common characteristics or developmental trajectories (Laursen & Hoff, 2006). Variable-centered analyses, on the other hand, assume that associations between variables are universal across the entire population and do not account for heterogeneity in development (Laursen & Hoff, 2006). Group-based trajectory analyses align with the theoretical orientation of person-oriented research, in that the procedure allows for the examination of multiple assessments of the outcome of interest, so that nonlinear trajectories can be estimated. Individuals are then classified into specific groups based on their unique developmental trajectories, highlighting subsamples of individuals that deviate from the typical findings of studies that have relied overwhelmingly on population averages to explain longitudinal growth. Subsequently the potential predictors and outcomes of membership into these unique groups can be empirically examined.

Group-based trajectory analyses using the procedures outlined by Nagin (2005) have been successfully implemented in the past to identify differential pathways of development for physical aggression (e.g., Broidy et al., 2003; Nagin & Tremblay, 1999). Given that self-regulation has been found to be related to externalizing problems and antisocial behaviors (Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002; Hill, Degnan, Calkins, & Keane, 2006; Supplee, Skuban, Shaw, & Prout, 2009; Tremblay, Pihl, Vitaro, & Dobkin, 1994; Trentacosta &

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Shaw, 2009), it stands to reason that individuals may undergo unique and divergent pathways of self-regulation development, similar to those found for the development of antisocial behaviors. Hay and Forrest (2006), for example, performed group-based trajectory analyses on the development of self-regulation (rated by parents) from ages 7 to 15 using a nationally representative sample, and found eight distinct groups. The majority of individuals demonstrated stability in both rank and individual growth, but approximately 16% of individuals experienced growth or declines in self-regulation as well as alterations in peer rank. How these individuals differ from those that remain stable in their abilities is an important consideration, as well as the identification of developmental precursors and contextual factors that facilitate growth or declines for individuals.

The findings of Hay and Forrest (2006) lend encouragement to the goal of the present study in discovering distinct developmental trajectories of self-regulation. However, the current study will capitalize on examining trajectories beginning in early childhood, a period of rapid growth in self-regulation (Blair, 2002) and will examine teacher reports of self-regulation, instead of parent reports. Although parents may provide useful insight into children's behavioral patterns during infancy and toddlerhood, as children age teachers may provide another important perspective, given the unique behavioral challenges that the classroom context presents. Several studies suggest robust connections between teacher reports of children's behaviors and adolescent outcomes including academic achievement (Breslau et al., 2009), criminal behavior, and antisocial personality disorder (Schaeffer, Petras, Ialongo, Poduska, & Kellam, 2003). Teacher and parent ratings of social behaviors also tend to be low to moderately correlated (e.g., Eisenberg et al., 2004; Fagan & Fantuzzo, 1999), which indicates that children may behave differently within the classroom than within the home. Another possibility is that teachers and

parents may be using different reference points as relative comparisons when rating children's behaviors. Teachers may rely on children's classmates as a comparison, whereas parents may use siblings or cousins. Therefore, teachers may provide a great deal of insight into rating children's behaviors in contexts that parents are less familiar with. Since the growth modeling studies mentioned earlier have relied on parent reports of children's self-regulation, modeling behaviors based on teacher report is an endeavor that is currently missing in the extant literature.

Finally, another novel aspect of the current study will be relating group membership to assessments of positive functioning in mid to late adolescence, and exploring these findings among a sample of low-income and a sample of predominantly middle-income children. Identification of children in high-risk samples who are struggling versus those who have adapted well is crucial to understanding how to effectively design programs to support their development.

2.1.1.1 Demographic differences across self-regulation groups

As a final consideration in the process of identifying and describing a grouping system for children's self-regulation trajectories, it is essential to determine the background characteristics of children in each group. The detection of maladaptive and adaptive trajectories enables researchers to examine differences in child characteristics across groups, so that individuals at higher risk for negative developmental outcomes can be identified early. These high-risk groups could be targeted in early childhood interventions with the goal of altering these pathways and improving any subsequent academic and social outcomes. Therefore, the present study will examine how several demographic characteristics vary across groups, including gender, race, household income, and maternal education. Despite the fact that analyses will also be run on a low-income sample, it is expected that there will still be enough heterogeneity in household income and maternal education to support such inquiries.

In U.S. samples, gender is a predictor of self-regulation such that girls tend to outperform boys on assessments of self-regulation (Li-Grining, 2007; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005) and teachers tend to report higher self-regulation for girls as well (Eisenberg et al., 2005a; Eisenberg et al., 2005b). Teachers also tend to rate African American children as less well-adjusted to school (Pigott & Cowen, 2000) and as having more behavior problems and fewer competencies (Sbarra & Pianta, 2001) than White children, lending support for the inclusion of child race as a predictor of trajectory group membership. Other studies have found that low-income school-aged children performed less well than middle-income children on a direct assessment of delay of gratification (Evans & English, 2002; Evans & Rosenbaum, 2008). Maternal education has also been related to self-regulation such that more highly educated mothers tend to have children with higher self-regulation (Bernier, Carlson, & Whipple, 2010). Therefore, the present study will examine if groups containing positive and adaptive self-regulation trajectories will have a larger proportion of girls, have higher household incomes (relative to the respective sample), and higher maternal education than the groups containing more detrimental trajectories. The following section will address the relationship between early self-regulation and several indicators of positive functioning in adolescence.

2.2 EARLY CHILDHOOD SELF-REGULATION AND POSITIVE FUNCTIONING IN ADOLESCENCE

In recent years there has been extensive work linking early childhood self-regulation to cognitive and social outcomes during early or middle childhood (e.g., Blair & Razza, 2007; Dobbs, Doctoroff, Fisher, & Arnold, 2006; Kochanska & Knaack, 2003; Olson et al., 2005; Valiente et

al., 2003; Valiente et al., 2004). There has been much less work linking early childhood self-regulation to outcomes in adolescence. This is unfortunate since rigorous empirical research establishing a link between early childhood self-regulation and positive social outcomes in adolescence would bolster support for the funding of early intervention programs that target the development of self-regulation skills.

Presently, a few studies have shed some light on the association between self-regulation and positive outcomes in early adulthood. A large longitudinal study from New Zealand (Dunedin Study) with a 1972-1973 birth cohort noted that individuals low in self-regulation at age three had lower quality relationships with a romantic partner, were more likely to be unemployed, and were more likely to abuse alcohol and attempt suicide at age 21 (Caspi, 2000). Extending outcomes for the Dunedin sample further into adulthood, researchers found that individuals with higher overall self-regulation (averaged at five time points across early and middle childhood) had better health, higher incomes, and engaged in less criminal behavior at age 32 (Moffitt et al., 2011). Few, if any, studies have examined the association between early childhood self-regulation and positive outcomes in late adolescence using more recent U.S. samples. The present study will employ two contemporary U.S. datasets (1991 birth cohorts) to examine the association between early childhood self-regulation and positive functioning in adolescence (academic engagement and motivation, romantic relationship quality, and workplace behaviors).

2.2.1 Theoretical frameworks connecting early childhood self-regulation with adolescent social functioning

Although there exists a large body of empirical work documenting the impact of early childhood self-regulation on child and (to a lesser extent) adolescent functioning, the importance of self-regulation for subsequent development is starkly lacking a strong theoretical orientation or framework to tie these developmental periods together. A number of researchers, however, have proposed theories to explain why early childhood experiences result in the development of maladaptive behaviors that are consistent throughout adolescence and adulthood and traverse multiple environmental contexts and domains of functioning. The *bridging model* (Shaw, Bell, & Gilliom, 2000), for example, has been proposed to explain how delinquent or aggressive behaviors develop and are maintained over time. Reflecting a synthesis of leading theories of early childhood development, the *bridging model* posits that children reared in stressful or abusive environments develop internal working models for alleviating stressful or frustrating situations by acting out aggressively. Due to the transactional nature of interpersonal relationships, as children behave aggressively and are met with hostility by parents, their behaviors become reinforced and exacerbated over time. Although aggression is modeled and reinforced at home, these behaviors become highly maladaptive in other contexts (e.g., school, dating), which sets the stage for further disruption in functioning.

Although this theory was proposed to describe the development and maintenance of antisocial behavioral trajectories, the model could be readily applied to self-regulation as well. When children are presented with an emotionally challenging or frustrating situation, they tend to rely on coping strategies that have been modeled or taught by their parents through socialization strategies (Smith et al., 2006). Children subsequently can use these strategies in

various contexts and situations, thereby resulting in a continuity of behaviors over time. The child's ability to appropriately demonstrate self-regulation in emotionally demanding situations will influence the nature of subsequent interactions with parents, teachers, siblings, peers, coworkers, etc. Increasingly negative interactions could serve to maintain low self-regulation, whereas positive ones should encourage continuous displays of high self-regulation. Consistent with the *continuity hypothesis* (Conger, Cui, Bryant, & Elder, 2000), these behaviors should transfer from the home environment (the main socializing agent in early childhood) to other contexts and situations. This would explain why an individual demonstrating low self-regulatory skills at home, should also demonstrate them at school, work, and with friends and romantic partners. As each of these contexts presents unique conflicts and challenges that require the use of appropriate self-regulatory skills to achieve successful resolutions, early self-regulatory behaviors and developmental trajectories should predict various indicators of positive functioning in adolescence, including academic engagement and motivation, workplace behaviors, and romantic relationship quality.

2.2.2 Positive youth development and successful functioning in adolescence

Traditionally, most research on adolescent development has focused on the divergent pathways toward detrimental outcomes (e.g., delinquency/criminal behaviors, teen pregnancy, high school dropout), and with just cause. As the ramifications of criminal behavior, teenage pregnancy, drug use, and high school dropout have proven costly to both the individuals that are affected as well as to the public at large, motivation for researching preventative programs and interventions has been at the forefront of policy for several decades. Much of this work has focused on how to locate and administer support to high-risk groups in order to lower the incidence of dysfunctional

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adolescent behaviors (e.g., Allen & Philliber, 2001; Bierman, 2002). It has only recently been recognized that other pathways of adolescent development have been under-researched and underfunded, particularly examining the association between positive developmental assets, such as self-regulation, and positive outcomes (Benson, Scales, Hamilton, & Sesma, 2006). In stark contrast to the "deficit model" (the traditional practice of identifying weaknesses, risk factors, or abnormalities), the theoretical orientation of "positive youth development" has set its goal on identifying various positive assets (e.g., traits, relationships, settings) that promote successful developmental trajectories for all youth, including the most disadvantaged groups. In this way, researchers can intervene early to not only prevent youth from falling into patterns of dysfunction, but to promote the types of positive social and interpersonal skills that are needed for successful transitioning into adulthood.

Aligning with the framework of positive youth development, the current paper focuses on detecting individual self-regulation pathways to positive functioning; pathways which began in early childhood and extend into middle and late adolescence. Although research on development during late adolescence and emerging adulthood has blossomed since the beginning of the 21st century, identifying the indicators of a successful transition to adulthood in the U.S. is not as clear cut as it was in the 1950s (Settersten Jr., & Ray, 2010). The past requirements for entering adulthood (i.e., financial independence, marriage, child-bearing), the quintessential staples of the post-World War II generation, are no longer viable necessities for today's youth. Changes in post-secondary educational requirements, financial aid availability, and increased access to contraception and career opportunities for women have resulted in a lengthened period of dependence on an individual's biological parents (Settersten Jr., & Ray, 2010). Subsequently, the mere fact that an individual has obtained full-time employment and has entered matrimony

provides little information on his/her chances of maintaining both gainful employment and a healthy long-lasting marriage. Therefore, examining financial independence, marriage, and parenting in late adolescence will not provide definitive information on an individual's chances of success in navigating complex life circumstances. Instead, the current paper will examine the association between self-regulation and three factors representing positive social functioning in adolescence: romantic relationship quality, academic engagement and motivation, and workplace behaviors. As these three factors encompass interpersonal social skills that are necessary for achieving and sustaining the traditional hallmarks of adulthood, these outcomes should hold greater relevance in demonstrating positive functioning.

2.2.2.1 Romantic relationship quality

Romantic relationships emerge in adolescence and represent a unique dynamic that is distinguishable from all other interpersonal relationships that remain prominent. Although there is substantial variability in the meaning and longevity of romantic relationships in adolescence - making these relationships difficult to define, operationalize, and measure - most scholars agree that in Western cultures romantic relationships are defined by three major characteristics: an ongoing connection with another person, a voluntary commitment, and an attraction, typically of a sexual nature (Brown, Feiring, & Furman, 1999). Despite the misconceptions that many romantic relationships in adolescence are only temporary and transitory, and therefore, should not be considered important determinants of adolescent functioning, there is evidence that the quality of these early romantic encounters do matter (Collins, 2003).

Romantic relationship quality typically refers to the extent to which individuals derive satisfactory, positive interactions with their partner (Collins, 2003). Quality encompasses the degree of emotional support, nurturance, and affection, as well as conflict, coercion, and

intimidation prevalent within a relationship (Galliher, Welsh, Rostosky, & Kawaguchi, 2004). Perceptions of the quality of partner interactions has been related to depression (Welsh, Galliher, Kawaguchi, & Rostosky, 1999) and social adaptation in adolescence (Zimmer-Gembeck, Siebenbruner, & Collins, 2001), and observations of couples' conflict resolution tactics have been related to relationship longevity (Shulman, Tuval-Mashiach, Levran, & Anbar, 2006). Other researchers speculate that adolescent romantic relationships set the foundation for the quality of subsequent relationships in adulthood (Brown et al., 1999).

Given the relative salience of romantic relationships in adolescence, a substantial body of research has focused on how pathways to highly conflicting and highly nurturing relationships originate. Much of this research has focused on how early patterns of parent-child attachment and interaction and peer relationships may influence the quality of early romantic relationships (Conger et al., 2000; Feeney & Noller, 1990; Furman, Simon, Shaffer, & Bouchey, 2002; Roisman, Collins, Sroufe, & Egeland, 2005). Attachment research, in particular, stresses the continuity of internal representations of learned patterns of behavior associated with interpersonal relationships. For example, if a child has learned that he cannot rely on his caregiver for emotional support, then he may distance himself emotionally from the caregiver to avoid disappointment. This internal working model for reducing the chances of being let down by one's partner, may encourage him to demonstrate the same behaviors with a romantic partner, regardless of the partner's ability to demonstrate support. Relating back to the *bridging model* and the *continuity hypothesis* discussed earlier, patterns of self-regulation learned and socialized through interactions with parents and siblings should translate to interactions with teachers, friends, and ultimately romantic partners. Particularly given that close relationships of an intimate nature pose challenges that should be affectively arousing (e.g., disagreements,

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jealousies, etc.), the manner in which individuals have dealt with arousing stimuli in other contexts in the past, should influence their behavior in adolescence. Subsequently, their ability to self-regulate during potentially intense situations in their romantic relationships should influence the quality of those relationships.

Some research does suggest that self-regulation may be related to romantic relationship quality. One study found that adolescents who reassess and reinterpret emotionally charged situations or problems are more likely to engage in higher quality interpersonal relationships characterized by greater closeness and emotional disclosure (Gross & John, 2003). Additionally, research has demonstrated that attachment styles and early interactions with caregivers predict conflict and the ability to regulate negative emotions with romantic partners (Creasey, Kershaw, & Boston, 1999). However, as most of the research on adolescent romantic relationships relies on early caregiver-child attachment styles, the examination of distinct self-regulation pathways relating to relationship quality should contribute uniquely to the literature base.

2.2.2.2 Academic engagement and motivation

Another important factor for determining successful functioning in adolescence is the degree of engagement and motivation with academic studies. Academic engagement has been defined in various ways in past literature. Some studies define it as intrinsic motivation for learning, such as enjoyment of learning, curiosity, and persistence in difficult tasks (e.g., Gottfried, Fleming, & Gottfried, 1998). Others look at two distinct patterns of engagement: behavioral engagement or active participation in the classroom, and emotional engagement or a sense of belonging or emotional attachment to the school, teachers, classmates, etc. (Ladd & Dinella, 2009; Li & Lerner, 2011). Both aspects of engagement are important in understanding individual variability in academic achievement, given that the desire to become an active agent in one's educational

pursuits and endeavors is related to academic performance (Guo, Connor, Tompkins, & Morrison, 2011; Ladd & Dinella, 2009; Li & Lerner, 2011). Additionally, academic engagement has been found to predict high school dropout in both Canadian (Archambault, Janosz, Fallu, & Pagani, 2009) and U.S. samples (Fall & Roberts, 2011). Given that 3.5% of students in the U.S. have dropped out of high school in 2007 (Chapman, Laird, & Kewal Ramani, 2010) and that low-income students are more likely to experience academic failure (Murray, 2009), it is important that researchers identify precursors to developing positive engagement and motivation with one's educational endeavors.

Since links have been demonstrated between self-regulation and achievement, and between engagement and achievement, it is worth examining the extent to which self-regulation may predict academic engagement. As individuals with low self-regulation have more difficulty suppressing maladaptive emotions and behaviors during conflicts or affectively arousing situations (DeWall, Baumeister, Stillman, & Gailliot, 2007), children with low self-regulation may be more likely to behave in an off-putting manner towards teachers and peers. This could affect the quality of their experiences in school and the nature of the relationships that they form with teachers and classmates. Having poor interpersonal social skills and negative relationships with important adults and peers in one's life can lead to feelings of loneliness and isolation and subsequently lead to feelings of disengagement from school. In fact, studies have demonstrated a positive link between self-regulation and academic engagement (Eisenberg, Valiente, & Eggum, 2010; Iyer, Kochenderfer-Ladd, Eisenberg, & Thompson, 2010; Silva et al., 2011; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008). A recent study even found that attentional persistence (a related dimension) in preschool predicted a greater likelihood to complete college at age 25 (McClelland, Acock, Piccinin, Rhea, & Stallings, 2012). Since most

of these studies have focused on academic engagement assessed in early or middle childhood, the current study will expand the literature by examining links between self-regulation (both early childhood levels and trajectories spanning early childhood and adolescence) and academic engagement measured in mid- to late adolescence.

2.2.2.3 Workplace behaviors

Another factor related to developmental functioning in adolescence is work habits. Workplace behaviors have been understudied in youth developmental literature, but there is reason to theorize that early childhood self-regulation should predict an individual's behaviors at work. Work habits are often described and measured in terms of workplace deviance and aggression (Neuman & Baron, 2005) or the extent to which workers' goals align with those of the organization or employer (Hodson, 1991). Workplace deviance is commonly organized along two dimensions of behaviors: organizational deviance - actions that are harmful to the organization - and interpersonal deviance - actions that are harmful to individuals (Robinson & Bennett, 1995).

Although workplace deviance is associated with perceptions of the work environment (e.g., job satisfaction) and other situational factors related to the place of employment (Colbert, Mount, Harter, Witt, & Barrick, 2004; Judge, Scott, & Ilies, 2006; Lee & Allen, 2002; Mount, Ilies, & Johnson, 2006), individual coping and regulatory strategies like self-regulation should predict workplace behaviors. Individual differences in self-regulation levels and trajectories should influence the manner in which employees relate to co-workers, employers, and their perceived workload. Employees who have difficulty regulating their emotions may also lack the ability to cope with typical on-the-job stressors, such as disagreements with co-workers, and tasks that are perceived to be demanding, demeaning, or monotonous in nature. These

individuals may consistently place their own needs or interests above those of their organization and fellow employees and may be less likely to cooperate or compromise, or offer assistance and support. Highly regulated individuals, on the other hand, may be much more likely to relegate their opinions in favor of a compromise during co-worker disagreements, and therefore, demonstrate more cooperative, supportive, and productive behaviors in the workplace. Despite the fact that little, if any, research has examined a potential connection between early childhood self-regulation and workplace behaviors in adolescents, the current study hypothesizes the existence of such a pathway, such that levels and trajectories of self-regulation will predict workplace behaviors in late adolescence.

2.2.3 Mechanisms that link early self-regulation to positive adolescent outcomes

Although early childhood self-regulation should clearly be demonstrated as a strong predictor of positive adolescent functioning, it is not always clear how these pathways emerge. Are there specific mechanisms that are shaped by individual differences in self-regulation over time, and are these mechanisms partially mediating or moderating the association between early childhood self-regulation and positive behaviors in adolescence? As Bronfenbrenner stressed in his highly influential theory of bioecological development (Bronfenbrenner & Morris, 2006), children do not develop in isolation, but rather are nested within multiple contextual layers that interact with each other and the individual to influence development over time. The most strikingly influential contextual factors in children's development, according to Bronfenbrenner and Morris (2006), are the *proximal processes*, or the regular interpersonal interactions that children have with significant adult figures in their lives. A substantial body of literature has focused on the significance of interpersonal relationships in shaping children's lives, with positive relationships

operating as a developmental asset or buffer against adversity (Benson et al., 2006; Rhodes & Roffman, 2003), and as the defining catalyst in successful interventions (Li & Julian, 2012). Since children's behaviors may influence the positive/negative valence of their daily encounters with adults, the maintenance of positive adult relationships should be the driving mechanisms that partially explain why highly regulated children are far more likely to experience more positive outcomes throughout life.

Children receive a significant amount of socialization in the two major developmental contexts of home and school; thus, close interpersonal relationships in these contexts should partially explain variability in developmental functioning. Although family dynamics (Schrag, Peris, & Emery, 2003) and peer relationships (Rubin, Bukowski, & Parker, 2006) are also important determinants of child development, the current study will focus on the interpersonal relationships children sustain with their teachers and parents, the prominent adult caregivers/socializers in both their home and school environments. Therefore, the parent-child relationship will be explored as both a potential mediator and moderator of the association between early childhood self-regulation and all three outcomes in adolescence: romantic relationship quality, academic engagement and motivation, and work behaviors in adolescence. The teacher-child relationship will also be examined as a mediator between early childhood self-regulation and academic engagement and motivation in adolescence.

2.2.3.1 Teacher-child relationship quality as a mediator between self-regulation and academic engagement and motivation

Although a substantial body of research focuses on how teachers and parents socialize children and influence their subsequent development, researchers often neglect the transactional nature of these relationships and how children can also impact adult behaviors. Bidirectional relationships

between child temperament and parenting (Clark, Kochanska, & Ready, 2000; Lengua & Kovacs, 2005) have demonstrated the necessity of viewing children as active agents in constructing their own developmental experiences. Patterson's (1982) coercion model, for example, theorized that children's antisocial behaviors are developed, reinforced, and sustained through conflicting interactions between parents and children. Over time children's deviant behaviors and parents' punitive discipline serve to sustain and escalate the aggressive behaviors of children. Just as parents shape children's behaviors through their parental strategies, children shape parenting through their behaviors.

Similar interactional patterns are naturally occurring between children and teachers. Children who demonstrate poorer regulatory abilities have more difficulty conforming to classroom rules and routines (Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009), and therefore, may experience conflict with teachers more often (Silver, Measelle, Armstrong, & Essex, 2005) and receive more sanctions for misbehavior. Over time, students with poorer teacher-child relationships may begin to feel frustrated and disengaged from school, which may lead to declines in motivation and engagement (Hamre & Pianta, 2001). On the other hand, children with higher self-regulation should be more likely to conform to classroom rules and experience positive interactions with teachers, which should relate to higher engagement, motivation, and participation in classroom activities. In fact, studies have shown that children with greater self-regulation had better relationships with teachers (Myers & Morris, 2009; Rudasill & Rimm-Kaufman, 2009), and that students with better relationships with teachers had greater engagement and liking of school (Birch & Ladd, 1997).

Although the concept of interpersonal relationships as important contributors to student academic engagement (Martin & Dowson, 2009) is not new, research examining the mediational

role of teacher-child relationship quality on self-regulation and academic engagement has been scarce. Silva and colleagues (2011) examined these associations and found that the teacher-child relationship significantly mediated the pathway between self-regulation (effortful control) and academic engagement (liking of school) among a sample of low-income preschool-aged children. Currently, no studies have attempted to estimate the size and strength of pathways that extend all the way from early childhood into middle or late adolescence. The novelty of this paper, therefore, will be to explore the pathway of early childhood self-regulation to adolescent academic engagement, through the mediational role of teacher-child relationship patterns in middle childhood using both low- and predominantly middle income samples.

2.2.3.2 Parent-child relationship quality as a mediator between self-regulation and romantic relationship quality, academic engagement, and workplace behaviors

The development of self-regulation over time occurs as both a function of individual traits and the environment, especially the quality of the mother-child relationship (Kochanska, Philibert, & Barry, 2009). Parenting styles have long been considered a powerful influence over the development of children's behavioral and emotional problems (Aunola & Nurmi, 2005; Barnes & Farrell, 1992). During the early and middle childhood years when the primary caregiver is a major socializing agent for the child's development, parenting is viewed as a determinant in the development of adaptive coping strategies and self-regulation (Eisenberg, Fabes, & Murphy, 1996; Smith et al., 2006).

The mechanisms through which individual differences in self-regulation arise due to varying childrearing practices are best articulated by attachment theory (Calkins & Leerkes, 2011). During infancy children must rely on parents to soothe, console, and distract them during times of distress. The manner through which caregivers respond to their children's needs serves

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as a model that children can later use to regulate their own affect as they become more independent and self-aware (Calkins & Hill, 2007; Sroufe, 1996). Children with responsive and sensitive caregivers should be more likely to develop adaptive self-regulatory methods, whereas children reared in households with inconsistent or harsh parenting should demonstrate less effective self-regulatory techniques.

However, the development of attachment is a dyadic, transactional process resulting from the interaction between caregiver behaviors and child temperament, such that the goodness-of-fit between parent and child will determine the development of adaptive vs. maladaptive behaviors (Dennis, 2006). This reflects back to the earlier mention of Patterson's coercion model (1982), which stresses how child and parent behaviors often influence one another in a cyclical fashion. Although this theory's main concern is to explain how aggressive behaviors in children are developed and maintained over time, the theory's principles can be applied to the development of positive behaviors as well. The association between early childhood self-regulation and adolescent functioning, therefore, may depend upon the quality of the parent-child relationship in early childhood. Additionally, as children age, those with more adaptive self-regulation skills should be more likely to experience positive encounters with their parents, and therefore, develop and maintain a more positive and supportive relationship with their parents. These questions lend support for the possibility of examining the parent-child relationship as a mediator of the link between self-regulation and adolescent outcomes.

Currently, empirical tests of child self-regulation influencing or predicting later parenting behaviors are lacking from the literature. Only a few studies have examined such pathways. For example, a study by Brody and Ge (2001) found support for a transactional relationship between self-regulation and parenting behaviors assessed in early adolescence, such that self-regulation

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predicted changes in harsh parenting behaviors. A bidirectional association was also supported between child temperament characteristics and parenting behaviors, such that irritability predicted less consistent parenting practices (Lengua & Kovacs, 2005). As children grow older and become increasingly independent and susceptible to influences outside of the familial household, parenting undergoes new and potentially unexpected challenges in response to children's changing behaviors. Hay and Forrest (2006), for example, found that changes in parenting practices in the second decade of a child's life significantly predicted changes in children's parent-reported self-control to age 15, even after controlling for earlier parenting practices. The discovery of parenting changes throughout adolescence supports the contention that parents may be altering their approach in response to maturational changes in children's behaviors. A parent-child relationship characterized by high warmth/closeness and little conflict, therefore, may be shaped by children's self-regulation to subsequently impact outcomes in adolescence.

Romantic relationships. In order to establish the mediating role of the parent-child relationship it is important to further address how this relationship is linked to subsequent interactions with romantic partners in adolescence. The most prominent theory to establish this connection is attachment theory (Ainsworth & Bowlby, 1991), which posits that children develop an internal working model of intimate relationships based upon their interactions with their primary caregivers. If children have supportive and sensitive parents, they come to learn that partners are reliable and supportive, and transfer those perceptions to their romantic partners. In this way, parent-child relationships may set the stage for the quality of intimate romantic relationships later in life.

Research seems to support an empirical link between parent-child relationship quality and romantic relationship quality. One study found that college students' perceptions of their relationships with their parents predicted romantic relationship quality, such that positive parent-child relationships were associated with less aggression and victimization among romantic partners (Linder, Crick, & Collins, 2002). Additionally, an association was found between parent-child interactions at age 13 and romantic relationship quality at age 20 (Roisman, Madsen, Hennighausen, Sroufe, & Collins, 2001). Internalized working models for relationships mediated this association, such that parent-child relationships operated as models for subsequent interactions with romantic partners. An additional study found that retrospective reports of supportive parenting practices were associated with more positive perceptions of the emotional availability of romantic partners among a sample of young adults (Dalton III, Frick-Horbury, & Kitzmann, 2006). Presently, there are no studies that test the association between early childhood self-regulation and romantic relationship quality in adolescence through the mediating role of parent-child relationship quality.

Academic engagement and motivation. Earlier sections illuminated how relationships with teachers may mediate the pathway between early childhood self-regulation and youth engagement and motivation to perform well in school. There may also be support for the quality of the parent-child relationship mediating the association between early childhood self-regulation and adolescent academic engagement and motivation. As Martin and Dowson (2009) point out, youth derive a sense of connectedness to school and define their academic identity through internalization of the values, feedback, encouragement, and support provided by their parents. Support for these theoretical viewpoints has been demonstrated by several studies. Middle-schoolers, for example, who perceived a greater sense of warmth and acceptance from their

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parents were more engaged in classroom activities (Furrer & Skinner, 2003). Active parental involvement in youths' scholastic endeavors also predicted academic engagement and motivation (Gonzalez-DeHass, Willems, & Doan Holbein, 2005), as well as motivation and perceived self-competence in math and English (Fan & Williams, 2010). Naturally, parental relationships high in warmth and low in conflict should promote a positive sense of belonging and motivation for youths. The present study, therefore, will explore the robustness of this relationship as a potential mediator between early childhood self-regulation and academic engagement and motivation in adolescence.

Workplace behaviors. A third indirect pathway that will be explored between early childhood self-regulation and adolescent functioning, is the association between the parent-child relationship and workplace behaviors. Coercive or harsh parenting styles have been consistently associated with childhood (Chang, Schwartz, Dodge, & McBride-Chang, 2003; Heidgerken, Hughes, Cavell, & Willson, 2004) and adolescent (Lansford, Criss, Pettit, Dodge, & Bates, 2003; Trentacosta & Shaw, 2008) aggressive and maladaptive behaviors. Likewise, greater parental involvement and monitoring has been associated with less delinquent behaviors among a sample of high-risk youth (Griffin, Botvin, Scheier, Diaz, & Miller, 2000). Furthermore, aggressive behaviors in childhood and adolescence have been associated with more disruption in the workplace including greater long-term unemployment, with supportive parenting operating as a protective factor (Kokko & Pulkkinen, 2000) and greater aggression in the workplace (Greenberg & Barling, 1999). Therefore, parent-child relationship quality should operate as a mediator of the direct pathway between early childhood self-regulation and adolescent workplace behaviors.

2.2.3.3 Parent-child relationship quality as a moderator of the association between self-regulation and academic engagement, romantic relationship quality, and workplace behaviors

Although early childhood behaviors may shape parent-child relationships, there is significant support throughout the literature that parent-child relationship quality may operate as a developmental buffer or asset against adversity. Relationships with parents that are characterized by high warmth/closeness and little conflict may promote optimal development for children with poorer self-regulation in early childhood. For example, one study demonstrated that as family risk factors accumulated, adolescents had poorer functioning (Forehand et al., 1991). However, adolescents with better relationships with their parents experienced better outcomes, even when facing numerous stressors in the household. Subsequently, parenting has been demonstrated as a protective factor against antisocial behaviors for women with a combination of genetic and environmental risk factors for developing aggression and impulsivity (Kinnally et al., 2009). Higher quality parenting has also been demonstrated to offset the detrimental effects of childhood aggressive behaviors on long-term unemployment as an adult (Kokko & Pulkkinen, 2000). Such research lends support for the role of the parent-child relationship moderating the association between child behaviors and adolescent outcomes. Therefore, in addition to examining the parent-child relationship in middle childhood as a mediator of the association between self-regulation and adolescent outcomes, the moderational role of the parent-child relationship in early childhood will also be explored.

2.3   SIGNIFICANCE OF THE RESEARCH PROPOSAL

The proposed dissertation makes several significant contributions to the field of applied developmental psychology. Whereas a number of researchers have stressed the importance of identifying precursors for the development of self-regulation as well as the overall pattern of self-regulation seen in normative populations, very few studies have actually examined self-regulation using group-based trajectory modeling from early childhood to adolescence. Capitalizing on these analyses will allow the identification of vulnerable groups of children who may be at risk for developing self-regulation at slower rates than others, children who may be stable low, or children who simply decline in self-regulation over time. Subsequently, studies that underscore the importance of self-regulation for successful adaptation to developmental challenges and transitions in life rarely extend the work from the preschool years to outcomes in mid- to late adolescence. Given that many social behaviors that emerge in adolescence impose large costs to both the private and public sector, establishing a clear link between early self-regulation and positive social outcomes in adolescence should largely inform policy work as well, focusing on the practicality of investing early to reduce the incidence of problems later.

Another strength to this study is the importance placed on establishing how long-term benefits from high self-regulation skills are achieved, despite the maturational increase in the number of obstacles and challenges that individuals face in-between assessments. Previous research connecting these early skills to social outcomes in adulthood (e.g., Caspi, 2000; Moffitt et al., 2011) has provided little insight into the mechanisms that mediate or moderate these connections, such as the various pathways through which intimate adult relationships may support these developmental outcomes. Improving children's self-regulation skills may inadvertently improve their relationships with parents and teachers, strengthening the support

systems that children need to adapt to challenges throughout life. Additionally, supportive parents may act as a developmental buffer for children experiencing difficulty regulating their emotions, thereby increasing their chances for developmental success relative to those with less supportive parents. Such findings could further bolster support for early childhood interventions targeting self-regulation skills.

Another crucial aspect of this proposed research design is the precedence that it lends to studying vulnerable low-income populations. The research questions will be examined using two longitudinal datasets. The first is a large multi-site dataset that consists mainly of middle-income participants. The second dataset consists of a sample of low-income boys, providing a high-risk sample for exploring the proposed research questions. Since individuals reared in low-income households are more likely to experience academic difficulty (Murray, 2009), drop out of school (Chapman et al., 2010), and experience relationship instability (Conger et al., 1990), it is essential to examine the developmental precursors to achieving positive outcomes in more vulnerable populations. Subsequently, since low-income individuals are more likely to have less adaptive self-regulatory skills compared to their higher income peers (Raver, 2002), uncovering positive trajectories and positive adult-child relationships among these high-risk populations would be informative for early childhood programming and policy. The present study, therefore, will address many of these gaps in the literature by addressing the questions listed in the following section.

2.4   RESEARCH GOALS

The current study is focused on establishing the link between self-regulation and positive developmental outcomes in adolescence while accounting for contextual factors that may influence these pathways. The first research goal is to examine the association between a direct assessment of self-regulation in early childhood and adolescent romantic relationship quality, academic engagement and motivation, and work habits. This work will enable researchers to demonstrate the importance of early childhood behaviors in determining the likelihood of developing and utilizing adaptive behaviors in adolescence. The second and third goals are to examine if adult-child relationships partially mediate the association between early childhood self-regulation and youth reports of developmental functioning. Specifically, the teacher-child relationship will be examined as a mediator between early childhood self-regulation and academic engagement and motivation, whereas the parent-child relationship will be examined as a mediator between early childhood self-regulation and all three outcomes: academic engagement, romantic relationship quality, and workplace behaviors.

The fourth aim will examine whether the parent-child relationship in early childhood moderates the association between early childhood self-regulation and academic engagement, romantic relationship quality, and workplace behaviors.

The fifth aim of the proposed dissertation is to examine variability in developmental trajectories of self-regulation using multiple teacher reports of child behavior from the preschool years to early adolescence. This will enable researchers to identify groups of children who remain stable, improve, or decline in self-regulation skills. The sixth goal will examine how gender, race/ethnicity, household income, and maternal education vary across groups by examining child and family characteristics as predictors of group membership. The seventh and

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final goal will link these trajectory groups to the adolescent outcomes examined in the first model: romantic relationship quality, academic engagement and motivation, and work habits.

The research aims will be examined using two longitudinal studies that follow children from infancy to adolescence: The National Institute of Child Health and Development Study of Early Child Care and Youth Development (NICHD SECCYD) and the Pitt Mother & Child Project (PMCP). (It is important to note that workplace behaviors were only assessed with the PMCP and, therefore, will not be examined in the NICHD SECCYD). Both datasets contain a range of multi-method measures (e.g., direct assessment, parent-report, teacher-report, and youth-report) assessing multiple environmental contexts (e.g., home, school, neighborhood factors). An added benefit of using both of these datasets is that the target participants were born in the U.S. in 1991, eliminating any cohort differences that may have influenced developmental outcomes. Finally, as an interest of this proposed research study is in examining vulnerable populations and comparing them to comparable low-risk samples, the NICHD SECCYD and the PMCP are well suited for this task. The PMCP is a high-risk sample comprised of low-income boys recruited from urban neighborhoods. The NICHD SECCYD is mostly comprised of a middle-income sample. Both datasets, therefore, will be explored to address the following research hypotheses:

2.4.1 Study 1: NICHD SECCYD dataset hypotheses

1. Self-regulation in early childhood will be positively associated with positive romantic relationship factors and negatively associated with negative romantic relationship factors in middle adolescence. Self-regulation will also be positively associated with academic engagement and motivation in middle adolescence. Higher self-regulation, therefore, will

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predict higher quality romantic relationships and higher academic engagement and motivation.

2. Self-regulation in early childhood will be positively associated with teacher-child closeness and negatively associated with teacher-child conflict in middle childhood. Closeness with teachers will positively predict academic engagement and motivation and conflict with teachers will negatively predict academic engagement and motivation. The teacher-child relationship will partially mediate the relationship between self-regulation and academic engagement and motivation.

3. Self-regulation in early childhood will positively predict parent-child closeness and negatively predict parent-child conflict in middle childhood. Parent-child closeness will positively predict academic engagement and positive romantic relationship factors and negatively predict negative romantic relationship factors. Parent-child conflict is expected to negatively predict academic engagement and positive romantic relationship factors and to positively predict negative romantic relationship factors. The parent-child relationship will partially mediate the pathway between early childhood self-regulation and both academic engagement and romantic relationship quality in middle adolescence.

4. Parent-child closeness and conflict in early childhood will moderate the association between self-regulation and academic engagement and romantic relationship quality, such that higher quality parenting will buffer the detrimental effects of poor self-regulation.

5. Heterogeneity in individual trajectories of self-regulation from early childhood to early adolescence will be detected.

6. Demographic characteristics will predict teacher-rated self-regulation trajectory group membership, such that groups with more positive trajectories will have a larger proportion of girls, Whites, higher household income, and higher maternal education. Groups with more negative trajectories will have a larger proportion of boys, African Americans, lower household income, and lower maternal education.

7. Group membership for self-regulation trajectories will significantly predict developmental outcomes in middle adolescence. Specifically, individuals belonging to groups with more positive developmental trajectories will have higher quality romantic relationships and greater academic engagement and motivation in middle adolescence. Individuals in groups with more negative trajectories will have lower quality romantic relationships and lower academic engagement and motivation.

2.4.2 Study 2: PMCP dataset hypotheses

1. Self-regulation in early childhood will be positively associated with romantic relationship quality and academic engagement and motivation in late adolescence. Self-regulation will be negatively associated with workplace behaviors in late adolescence, such that higher self-regulation will predict less workplace deviancy.

2. Self-regulation in early childhood will be positively associated with teacher-child closeness and negatively associated with teacher-child conflict in middle childhood. Higher closeness and lower conflict with teachers will predict greater likelihood of pursuing higher education versus lower education. The teacher-child relationship will partially mediate the link between self-regulation and academic engagement and motivation.

3. Self-regulation in early childhood will be positively associated with parent-child closeness and negatively associated with parent-child conflict in middle childhood. Parent-child closeness will positively predict romantic relationship quality, negatively predict workplace deviancy, and predict a greater likelihood of pursuing higher versus lower education. Parent-child conflict will be expected to negatively predict romantic relationship quality, positively predict workplace deviancy, and predict a greater likelihood of pursuing lower versus higher education. The parent-child relationship will partially mediate the pathway between self-regulation and romantic relationship quality, workplace deviancy, and academic engagement and motivation.

4. Parent-child closeness and conflict in early childhood will moderate the association between self-regulation and academic engagement, romantic relationship quality, and workplace behaviors, such that higher quality parenting buffers the detrimental effects of poor self-regulation.

5. Heterogeneity in individual trajectories of self-regulation from early childhood to early adolescence will be detected.

6. Demographic characteristics will predict teacher-rated self-regulation trajectory group membership, such that groups with more positive trajectories will have a larger proportion of Whites, higher household income, and higher maternal education. Groups with more negative trajectories will have a greater proportion of African Americans, lower household income, and lower maternal education.

7. Group membership for self-regulation trajectories will significantly predict developmental outcomes in late adolescence. Specifically, individuals belonging to groups with more positive developmental trajectories will have higher quality romantic

relationships, greater academic engagement and motivation, and less deviant workplace behaviors in late adolescence. Individuals belonging to groups with more negative trajectories will have lower quality romantic relationships, lower academic engagement and motivation, and higher workplace deviancy.

3.0 METHODS

3.1 STUDY 1: NICHD DATASET METHODS

3.1.1 Participants

For the first study, research questions will be examined using the NICHD SECCYD. The NICHD SECCYD is a large longitudinal dataset which followed children from birth (1991 birth cohort) to age 15 in 10 different locations throughout the U.S. Data collection was broken up into four phases: Phase I (birth to 3 years), Phase II (54 months to 1st grade), Phase III (2nd to 6th grade), and Phase IV (7th grade to age 15 years). Mothers were approached in the hospital after the birth of a child for recruitment in the study. Mothers were intentionally excluded if they were under 18 years of age, if the child had a known disability (NICHD ECCRN, 2004), if they could not speak English, or if they planned to move in three years (Vandell et al., 2010). Among the eligible families approached for participation, a total sample of 1364 were randomly selected and officially recruited for the study (Vandell et al., 2010).

Among the sample, 52% of the target child participants were male, 76%, were classified as White, 13% as African American, 6% as Hispanic, and 5% as Other (Vandell et al., 2010). Vandell et al. (2010) also reported that approximately one fourth of the mothers (26%) had a high school diploma or less, and approximately 21% could be classified as low-income or

poverty-stricken (200% the poverty line or less). Naturally, as with most longitudinal studies, the sample decreased with each subsequent phase of data collection. By Phase IV, only 1009 families remained in the study, which comprised approximately 74% of the original sample (National Institutes of Health NICHD, 2012).

3.1.2 Measures

3.1.2.1 Self-regulation

Early childhood direct assessment. Self-regulation was assessed in a laboratory setting at 54 months (4.5 years of age) using a delay of gratification task developed by Mischel and Ebbesen (1970). Children were placed in a room with two plates of a desired snack: one with a smaller quantity and one with a larger quantity. After the children acknowledged that they would prefer to receive the larger quantity, the examiner explained the rules of the game. Children were told if they waited until the examiner returned they would receive the larger quantity of food. However, if they couldn't wait the full amount of time (seven minutes), they could ring a bell to summon the examiner and they would receive the smaller portion. Children were then left alone in the room and were observed during the task through a two-way mirror.

Scores were coded as pass or fail with children passing if they waited the full seven minutes without summoning the researcher or eating the snack. Failed scores were given if the child rang the bell, started eating the snack, summoned the caregiver or the examiner, went to the door, or become distressed during the trial.

Middle childhood teacher report. Teachers reported on children's self-regulatory behaviors within the classroom at six time points (kindergarten, first grade, third grade, fourth grade, fifth grade, and sixth grade) using the self-control subscale from the Social Skills Rating

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System (SSRS, Gresham & Elliott, 1990). The self-control subscale is a 10-item measure in which teachers rate the frequency of children's behaviors on a 3-point scale (0 = *never*, 1 = *sometimes*, 2 = *very often*). Items were summed with higher scores indicating greater self-regulation. The average reliability across all six time points was .88 (alphas ranged from .87 to .89).

3.1.2.2 Middle childhood process mechanisms

Teacher-child relationship. Teacher-child relationship quality was assessed using the Student-Teacher Relationship Scale (STRS; Pianta & Steinberg, 1991). The STRS contains two subscales: a conflict subscale and a closeness subscale. Teachers rated the degree of perceived conflict (seven items) and perceived warmth/closeness (five items) in their interactions with the target child (1 = *definitely does not apply*; 5 = *definitely applies*) in fourth, fifth, and sixth grades. Items were then summed and averaged across all three time points, with larger scores corresponding to greater perceived conflict and greater perceived closeness. Cronbach's alphas ranged from .81 to .83 for closeness and .90 to .91 for conflict. Additionally caregivers (e.g., relatives, child care workers) completed a longer version of the questionnaire when children were 54 months. This measure was used as an earlier control in the mediation analyses when the teacher-child relationship in middle childhood was regressed on early childhood self-regulation (Pathway A: see Figure 1). Cronbach's alphas at 54 months were .81 for closeness (five items) and .85 for conflict (10 items).

Parent-child relationship. The quality of interactions between the primary caregiver and the child was also assessed using the Adult-Child Relationship Scale (ACRS), a variation of the STRS which rephrases items to better reflect the relationship between parent and child. When children were in fourth, fifth, and sixth grades, mothers rated the amount of closeness and

conflict they perceived with their child (1 = *definitely does not apply*; 5 = *definitely applies*) using a 5-item measure to capture closeness and a 7-item measure to capture conflict. Scoring procedures were the same as those developed for the STRS; items were summed and averaged across all three time points, with larger scores on each dimension corresponding to greater closeness and greater conflict. Cronbach's alphas ranged from .75 to .77 for closeness and .83 to .86 for conflict. A longer version of the measure was also completed by mothers when children were 54 months. The 54 month assessments of parent-child closeness and conflict were used as the moderator variables and also as earlier controls of relationship quality in the mediation analyses. Cronbach's alphas were .65 for closeness (five items) and .83 for conflict (10 items).

3.1.2.3 Adolescent outcomes

Romantic relationship quality. Youth completed questionnaires about the quality of their relationship with a romantic partner at age 15 using items from the Network of Relationships Inventory (NRI; Furman, 1996). It is important to note that only individuals that were in relationships completed this survey. The inventory contains 29 items measuring the youth's impressions of the relationship including the amount of conflict, the amount of warmth and disclosure, and the amount of pleasure derived from being with their partner. Responses were rated on a 5-point scale (1 = *little or none*; 5 = *"the most"!*). The current study excluded items gauging participants' perceptions of their partners' behavior in favor of items focusing on the participants' behavior toward the partner and general perceptions of the relationship. A factor analysis was conducted in SPSS on these remaining items. The results indicated that a two dimension scale best fit the response patterns: a positive relationship factor (e.g., closeness, open disclosure, enjoyment) made up of eight items and a negative factor (e.g., conflicts, annoyance, anger) consisting of six items. Items were summed with higher scores indicating greater positive

aspects of the relationship for the positive relationship dimension and greater negative qualities for the negative relationship dimension. Cronbach's alphas for both factors were high, .87 for positive qualities and .93 for negative qualities.

Academic engagement and motivation. At age 15, youth also completed a survey assessing their educational engagement, aspirations, and motivation. Three items, taken from Cook et al. (1996) asked youth to estimate the likelihood (1 = *not at all sure*; 5 = *very sure*) that they will complete high school, attend college, and complete college. An additional 10 items were adapted from the Self and Task Perception Questionnaire (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002). Youth rated their beliefs about their abilities and the value that they place on studying math and English using a 7-point response scale. Items were summed with greater scores reflecting greater educational engagement, motivation, and aspirations. Cronbach's alphas for the composites were high: .83 likelihood for school completion, .84 for the math items, and .83 for the English items.

3.1.2.4 Covariates

Family and child demographics obtained from parent questionnaires were included as covariates in the analyses. Child gender (0 = *female*; 1 = *male)* and dummies for child race/ethnicity: child African American (0 = *everything else*; 1 = *non-Hispanic Black*) and child Hispanic (0 = *everything else*; 1 = *Hispanic*), were used in all models. Family demographics, such as maternal education (years of schooling) obtained at one month, annual household income (averaged across 24, 36, and 54 months) rescaled due to large range (divided by 1000) for analyses, and marital status (0 = *everything else*; 1 = *married*) obtained at 54 months were also entered as covariates in the models. Additionally, two other variables were utilized as proxy controls for the dependent variables that were not measured at earlier time points. Friendship quality, for example, was

included as an earlier control for romantic relationship quality. At 54 months children were videotaped interacting with a close friend in three different 20 minute play sessions at their child care centers or homes. Observers rated children on their prosocial behaviors, by noting the extent to which the target child shared, included their friend in activities, and took turns with their playmate. Prosocial behaviors were rated on a 5-point scale (1 = *low*; 5 = *very high*) and averaged across all three activities. A total of 21 items were summed with higher scores reflecting greater prosocial behaviors. Cronbach's alpha was .87. Prosocial interactions in friendly dyadic activities were also observed and coded when children were in fourth grade. Children's prosocial and negative behaviors were observed in four different activities: eating a snack, playing a competitive game, planning a party, and free play. Each activity lasted approximately 7 to 10 minutes and behaviors were rated on a 5-point scale (1 = *not at all characteristic*; 5 = *highly characteristic*). Four items were summed with higher scores reflecting greater positive and prosocial behaviors in interactions with friends. Cronbach's alpha was .79. The 54 month early childhood assessment was used as an earlier control for romantic relationship quality for the mediational analyses to establish temporal consistency in pathways. The middle childhood assessment was used in all other analyses.

A measure of children's academic competence was included as an earlier control for academic engagement and motivation in adolescence. Teachers reported on children's general competencies in literacy skills in kindergarten, third grade, and fifth grade. The literacy measure consisted of 13 items in kindergarten and 10 items in third and fifth grade, measured on a 5-point scale (1 = *not yet*; 5 = *proficient*), which indicated the extent to which children have mastered specific skills. Items were summed for the kindergarten measure and summed and averaged across third and fifth grade to create a middle childhood composite. Higher scores reflected

greater competency in literacy. Cronbach's alphas ranged from .95 to .96. Once again, the early childhood assessment was used as an earlier control for academic engagement for the mediational analyses due to the temporal order of the data, while the middle childhood assessments were used in all other analyses.

3.2 STUDY 2: PMCP DATASET METHODS

3.2.1 Participants

Families enrolled in the Pitt Mother and Child Project were recruited from Allegheny County's Women, Infants, and Children (WIC) Program within the Pittsburgh metropolitan area. WIC enrollees were selected due to the study's original goal of researching a subgroup of individuals with an increased risk of developing antisocial and delinquent behaviors (Shaw, Gilliom, Ingoldsby, & Nagin, 2003). Therefore, target children for the sample consisted of boys reared in low-income households. Mothers were approached when the target child was between 6 and 17 months old over the course of a two year period. Originally, 421 families were selected, but the starting sample at the first wave of data collection (target child was 18 months of age) consisted of 310 child participants (Shaw et al., 2003). Data was collected at 14 waves beginning at age 1.5 and ending at age 21 with continued assessments projected to occur when the target individuals are ages 22 and 23 years. By the age 20 assessment approximately 245 children remained in the sample. At the first assessment (age 1.5 years), 54% of mothers were European American, 40% were African American, 0.6% were Hispanic, and the remaining 5% described themselves as Other. Among the child participants, 51% were European American, 39% were

African American, 0.3% were Hispanic, and 9% were classified as *Other*. The average age of mothers was approximately 27, with a range of 17-43 years. Mothers also reported completing approximately 12 years of education (completing high school), with a range of 8-18 years of schooling. Family household income was also reported to be an average of $1047 per month with a range of $205-$4000. Under half of the mothers in the sample were married (44%), with the remainder classifying themselves as single (28%), cohabiting (21%), separated (6%), divorced (2%), and widowed (0.3%).

3.2.2 Measures

3.2.2.1 Self-regulation

Early childhood direct assessment. A direct assessment of self-regulation was given to children in a laboratory setting at age 3.5 years (42 months) using the cookie waiting task - a measure of delay of gratification – derived from procedures created by Marvin (1977). Mothers and their sons were placed in a room that was cleared of all toys. Examiners gave the mother a clear bag with a cookie inside and told her to keep the bag in full view of the child, but out of his reach. Mothers were then told to complete questionnaires and keep the cookie from the child. The trial lasted for three minutes after which time the child was given the cookie. Sessions were videotaped and later coded using an emotion regulation coding system based on work by Grolnick, Bridges, and Connell (1996).

A time-sampling coding system was employed in which trained observers coded the absence or presence of five behaviors (*active distraction, passive waiting, information gathering, physical comfort seeking, and focus on delay object or waiting task*) in each 10 second cycle. Given that *active distraction* and *focus on delay object* were the two behaviors most closely

linked to the emotional self-regulatory behaviors of interest (Trentacosta & Shaw, 2009), these were the behaviors that were examined. *Active distraction* was coded when children engaged in behaviors that did not include the desired object as a focus of attention (e.g., fantasy play, turning lights on and off, talking with mother). *Focus on delay object or waiting task* was coded when the child's attention was focused on the cookie (e.g., speaking about or looking at cookie, trying to obtain cookie). Behaviors were only double-coded during 10 second intervals when *physical comfort seeking* occurred simultaneously with another behavior, otherwise only one code was given per cycle. Inter-rater reliabilities with a master coder were reported by Gilliom et al. (2002) using both percentage agreement (89%-96%) and kappa agreement (.64-.79). Frequencies of each behavior were totaled, with more time spent focusing on the delay object reflecting less self-regulation and more time spent in active distraction reflecting greater self-regulation.

Middle childhood teacher report. Children's self-regulation was also rated by teachers using the self-control subscale of the SSRS at ages 6 (72 months), 7, 8, 11, and 12 years. The average reliability across all five time points was .90 (alphas ranged from .88 to .91). Descriptions of the measure were provided in the methods section for Study 1.

3.2.2.2 Middle childhood process mechanisms

Teacher-child relationship. Teachers rated the quality of their relationship with the target child at ages 10, 11, and 12 years using the STRS. Descriptions of the measure are included in the Study 1 methods section. Closeness consisted of five items and conflict consisted of 10 items. Composites were created by summing items and averaging across all three ages. Cronbach's alphas ranged from .79-.83 for closeness and .92-.93 for conflict.

Parent-child relationship. Mothers also rated the quality of their relationship with their children at ages 10, 11, and 12 using the ACRS. Descriptions for the measure were provided in the methods section for Study 1. Closeness was comprised of five items and conflict was comprised of 10 items. Composites were summed and averaged across all three time points. Cronbach's alphas ranged from .75 to .77 for the closeness subscale and ranged from .88 to .89 for the conflict subscale. The quality of the parent-child relationship was also assessed when children were 72 months. These earlier measurements of parent-child closeness and conflict were included as the moderator variables. Cronbach's alphas were .71 for closeness and .86 for conflict.

3.2.2.3 Adolescent outcomes

Romantic relationship quality. At age 20 youth completed the Quality Marriage Index (Norton, 1983), a 5-item measure assessing the extent of satisfaction with their romantic partner. Responses asked participants to rate the degree of agreement or disagreement with statements gauging their feelings about their relationship (1 = *Strongly Disagree*; 5 = *Strongly Agree*). Higher scores reflect more satisfaction with one's partner. Cronbach's alpha was .97.

Academic engagement and motivation. Participants were asked at age 20, to indicate the highest level of schooling they would like to complete. Scores were coded to reflect three different groups (1 = *High School/GED/or less*; 2 = *Associate's or Bachelor's Degree*; 3 = *Graduate Degree*).

Workplace behaviors. In order to assess workplace behaviors, participants completed the Workplace Deviance Questionnaire (Bennett & Robinson, 2000) at age 20. The measure is a 25 item questionnaire assessing both interpersonal (harmful behaviors directed at individuals) and organizational (harmful behaviors directed at the organization or institution) deviant

behaviors. Participants indicated frequencies of antisocial behaviors using a 7-point scale (0 = *Never*; 6 = *Daily*). Items were summed with higher scores indicating greater workplace deviancy. Internal consistency estimates for interpersonal deviancy (eight items) and organizational deviancy (17 items) were α = .81 and α = .85, respectively.

3.2.2.4 Covariates

A number of child and family demographic variables were included in the analyses as covariates. Maternal education (years of schooling) reported at 42 months, annual household income (averaged across 42, 60, and 72 months) rescaled due to large range (divided by 1000), and maternal marital status (0 = *everything else*; 1 = *married*) reported at 42 months were included in all analyses. Dummies for child race/ethnicity: child African American (0 = *everything else*; 1 = *non-Hispanic Black*) and child Hispanic/other (0 = *everything else*; 1 = *Hispanic/other*), were also included in all models.

Youth also completed the Peer Relationship Questionnaire (Lathrop, Dishion, & Capaldi, 1987) at age 17. Three items were used to rate the positive features of their friendship on a 5-point scale. Scores were summed with higher scores reflecting greater positive features of the friendship. Internal consistency was .61. In order to maintain temporal consistency, this composite was included as an earlier control for romantic relationship quality in all analyses with the exception of the mediational models.

At age 12, perceived academic competence was measured through child report using the Harter Perceived Competence Scale for Children (Harter, 1982). Children rated their perceived competency with schoolwork relative to their peers with four items (1 = *low perceived competence*; 4 = *high perceived competence*). Items were summed with higher scores reflecting higher perceived competence. Cronbach's alpha was .72. This measure was used as an earlier

control for academic engagement and motivation in all models with the exception of the mediation analyses.

Childhood aggression was also reported by parents when children were 72 months old using the Proactive Reactive Behavior Questionnaire/Parent's Behavior Checklist (Dodge & Coie, 1987). Parents rated children's proactively aggressive behaviors on a 5-point scale (0 = *never true*; 4 = *almost always true*), using three items which were then summed to create a total proactive aggression composite. Higher scores reflected greater childhood proactive aggression. Cronbach's alpha for the scale was .73. This measure was used as an earlier control for adolescent workplace behaviors in all models with the exception of the mediation models.

3.3   ANALYTIC STRATEGY

3.3.1   Missing data analyses

In order to prevent the issues of attrition bias which may result from listwise deletion, multiple data imputation was conducted using IBM SPSS 20. Although there is a lack of consensus in the field over whether missing values on dependent variables should be imputed or deleted from the analyses, researchers have argued that both dependent and independent variables should be treated similarly when analyzing missing data (Schafer & Graham, 2002). Therefore, missing values on both independent and dependent variables were imputed for both datasets, with a total of five imputations computed based on Rubin's (1987) relative efficiency calculation. The only exceptions were that romantic relationship quality and trajectory group membership were not imputed for either dataset. This decision was made due to the uncertainty

of estimating values for a large number of individuals (the majority in both cases) that were not in a relationship at the time of the assessment, and the uncertainty associated with using trajectory group membership *approximations* to *estimate* group membership for individuals missing all data points. Therefore, a dummy variable was created for both variables (romantic relationship data: 0 = *no*, 1 = *yes*; trajectory group membership data: 0 = *no*, 1 = *yes*), so that both variables could be represented in the multiple data imputation without actually being imputed. Therefore, all analyses contained the full imputed dataset of independent and dependent variables with the exceptions of the trajectory group membership and the romantic relationship quality runs.

3.3.2 Hypothesis 1: Adolescent outcomes regressed on early childhood self-regulation

The first hypothesis was examined by conducting OLS regressions in Stata 12 (StataCorp, 2011). These equations regressed romantic relationship quality, academic engagement and motivation, and workplace behaviors obtained in adolescence onto a direct assessment of self-regulation obtained in early childhood. The only exception was the engagement models in the PMCP which required multinomial logistic regression to predict the three engagement categories. Equation 1.1 below addressed this question:

$$(1.1) \quad Adolescent \ Outcomes_i = \beta_0 + \beta_1 Self\text{-}Regulation_i + \beta_2 Child \ and \ Family \ Demographics_i + \beta_3 Outcome \ Controls_i + e_i$$

A direct assessment of self-regulation obtained during the preschool years served as the main predictor of the adolescent outcomes obtained at age 15 for the NICHD SECCYD and at age 20

for the PMCP. Both models examined romantic relationship quality and academic engagement and motivation as dependent variables, but workplace behaviors was only explored using the PMCP as this measure was not obtained using the NICHD SECCYD. Child and family demographic variables and earlier outcome controls were also included.

3.3.3 Hypothesis 2: Teacher-child relationship in middle childhood mediates the association between early childhood self-regulation and adolescent academic engagement and motivation

The second hypothesis examined the association between early childhood self-regulation and adolescent academic engagement and motivation through the mediation of the teacher-child relationship in middle childhood. This question was addressed using a series of steps in Stata outlined by Preacher and Hayes (2008). First, early childhood self-regulation was modeled as a predictor of the teacher-child relationship in middle childhood, predicting Pathway A (the independent variable predicting the mediator). The model is described using equation 2.1.

(2.1) Teacher-Child Relationship$_i$ = β_0 + β_1Self-Regulation$_i$ + β_2Child and Family Demographics$_i$ + β_3Teacher-Child Relationship Control$_i$ + e_i

Once again child and family demographics were included in the model as covariates, as well as ratings of the caregiver-child relationship during early childhood as an earlier control for teacher-child relationship quality for the NICHD SECCYD. In the PMCP, no earlier teacher-child relationship quality control was included because self-regulation was assessed prior to the attainment of this measure. Second, self-regulation in early childhood and the teacher-child

relationship in middle childhood were both included as predictors of academic engagement, modeling Pathway B (the mediator predicting the dependent variable, while controlling for the independent variable). Pathway B is detailed below in equation 2.2:

(2.2) Academic Engagement and Motivation$_i$ = β$_0$ + β$_1$Self-Regulation$_i$ + β$_2$Child and Family Demographics$_i$ + β$_3$Teacher-Child Relationship$_i$ + β$_4$Academic Engagement and Motivation Control$_i$ + e$_i$

Child and family demographics were included for both datasets. For the NICHD SECCYD, outcome controls were also entered into the models, but not for the PMCP as the possible controls were measured after self-regulation. Third, tests of mediation were examined using an online statistical calculator (Soper, 2009) which estimates the significance of the indirect effect using techniques described by Sobel (1982).

3.3.4 Hypothesis 3: Parent-child relationship in middle childhood mediates the association between early childhood self-regulation and adolescent academic engagement, romantic relationship quality, and workplace behaviors

The third hypothesis examined whether the parent-child relationship in middle childhood mediated the association between early childhood self-regulation and adolescent academic engagement, romantic relationship quality, and workplace behaviors (PMCP only). This question was addressed using a similar series of steps that were used with the second hypothesis. First, Pathway A was estimated using equation 3.1, in which early childhood self-regulation was modeled as a predictor of the parent-child relationship in middle childhood. Second, adolescent

outcomes were regressed on self-regulation and parent-child relationship quality using equation 3.2 (Pathway B).

> *(3.1) Parent-Child Relationship$_i$ = β_0 + β_1Self-Regulation$_i$ + β_2Child and Family Demographics$_i$ + β_3Parent-Child Relationship Control$_i$ + e_i*

> *(3.2) Adolescent Outcomes$_i$ = β_0 + β_1Self-Regulation$_i$ + β_2Child and Family Demographics$_i$ + β_3Parent-Child Relationship$_i$ + β_4Outcome Control$_i$ + e_i*

Child and family demographics were included. Outcome controls for the NICHD SECCYD were also included, but not for PMCP as the controls were measured after self-regulation. Once again, an online statistical calculator (Soper, 2009), was used to formally test the significance of the indirect effect.

3.3.5   Hypothesis 4: Parent-child relationship in early childhood moderates the association between early childhood self-regulation and academic engagement, romantic relationship quality, and workplace behaviors in adolescence

The fourth hypothesis examined whether the parent-child relationship in early childhood moderated the association between early childhood self-regulation and adolescent academic engagement, romantic relationship quality, and workplace behaviors (PMCP only). The majority of these questions were addressed using OLS regressions in Stata using equation (4.1):

(4.1) Adolescent Outcomes$_i$ = β$_0$ + β$_1$Self-Regulation$_i$ + β$_2$Parent-Child Relationship$_i$ +

β$_3$Parent-Child Relationship x Self-Regulation$_i$ + β$_4$Child and Family Demographics$_i$ +

β$_5$Outcome Control$_i$ + e$_i$

β$_3$ represents the slope term for the interaction between early childhood parent-child relationship quality and self-regulation. Child and family demographics and outcome controls were also included for both datasets. The interaction terms were tested and interpreted according to procedures described by Aiken and West (1991).

3.3.6   Hypothesis 5: Group-based trajectory modeling of early childhood through early adolescence self-regulation

In order to address the fifth hypothesis for both datasets, heterogeneity in developmental trajectories of teacher ratings of self-regulation was estimated using a specified semi-parametric mixture modeling method known as "finite mixture modeling" (Nagin, 2005). This procedure was completed in Stata 12.   Finite mixture modeling assumes that a finite number of homogenous trajectory groups exist to describe a continuous distribution of the behavior of interest. The group-based model can be specified for different distributions including Poisson and logit, but for the present study, the model will be used to describe a censored normal distribution. Given the small range of responses on the teacher ratings of self-regulation (0 to 2), and the tendency for individuals to be clustered at the minimum or maximum for such behavioral ratings, estimating trajectories for a censored normal distribution was the best method of choice for this study (Hay & Forrest, 2006; Nagin & Tremblay, 1999).   Trajectory groups were

approximated by defining self-regulation as a quadratic function of the child's age. The function is listed in equation 5.1 below:

$$(5.1) \quad Y_{it}^{*j} = \beta_0^j + \beta_1^j Age_{it} + \beta_2^j Age_{it}^2 + e$$

Where Y_{it}^{*j} is a latent variable describing the self-regulation of subject i at time t in group j. Age_{it} represents the age of subject i at time t and Age_{it}^2 is the square of the age of subject i at time t. β_0^j, β_1^j, and β_2^j represent the shape of the developmental trajectory for group j. The benefit of this model is that it allows for parameter estimates to vary across groups, thereby enabling heterogeneity in developmental trajectories to be modeled (Nagin & Tremblay, 1999). The optimal number of groups selected and used for subsequent analyses was determined using the Bayesian Information Criterion (BIC), as recommended by D'Unger, Land, McCall, and Nagin (1998). The BIC prefers a parsimonious model favoring the best model fit for the fewest possible number of groups (Nagin & Tremblay, 1999).

In addition to calculating the shape of the self-regulation trajectories for each group, the posterior probability of each child's membership in each group was estimated. The posterior probability provides an estimate of the probability that individual A belongs in a specific trajectory group based on their pattern of behavior at different ages (Nagin, 2005). According to Nagin's (2005) descriptions, if individual A is consistently rated as having poor self-regulation at each age of assessment, then A should have a posterior probability of zero for belonging to a high-self-regulation group and a posterior probability of one for belonging to a low-self-regulation group. The posterior probability calculation provides an objective method for

selecting group membership for each individual (Nagin, 2005). For the present study the largest posterior probability calculated for each individual determined their group membership.

3.3.7 Hypothesis 6: Child gender, child race/ethnicity, income, and maternal education as predictors of trajectory group membership

The sixth hypothesis examined whether child gender, child race/ethnicity, household income, and maternal education predicted membership in positive self-regulation trajectory groups (e.g., stable high or improving) relative to less positive groups (e.g., low stable or declining). Multinomial logit analyses were conducted to address this question. A logit analysis computes a risk ratio, which represents the change in the likelihood that an individual belongs to a group based on a 1-unit increase in the predictor of interest. A logit, for example, will indicate the likelihood that an individual is classified into a high self-regulation group based on a 1-unit increase in household income. The logit model is represented in equation 6.1:

$$(6.1)\ g(Trajectory\ Group_i) = \beta_0 + \beta_1 Child\ and\ Family\ Demographics_i + e_i$$

As mentioned previously, the early childhood predictors of interest were child gender (NICHD SECCYD only), child race/ethnicity, maternal education, and household income.

3.3.8 Hypothesis 7: Trajectory group membership as predictors of adolescent outcomes

The seventh hypothesis examined whether group membership in positive self-regulation trajectory groups predicted positive functioning in adolescence, relative to the less positive

trajectory groups. The outcomes of interest for both the NICHD SECCYD and the PMCP were romantic relationship quality and academic engagement and motivation. For the PMCP workplace behaviors was included as a third dependent variable. The majority of analyses were run using OLS regressions in Stata, using the following equation (7.1):

(7.1) Adolescent Outcomes$_i$ = β_0 + β_1Trajectory Group$_i$ + β_2Child and Family Demographics$_i$ + β_3Outcome Controls$_i$ + e_i

The variable *Trajectory Group$_i$* represents the self-regulation trajectory groups which were entered as a set of dummy variables. Child and family demographics were included in the model as controls. Controls for the adolescent outcomes were entered as predictors in order to model a lagged regression design for the dependent variables for both datasets.

4.0   RESULTS

4.1   STUDY 1: NICHD SECCYD FINDINGS

4.1.1   Descriptive statistics

Descriptive Statistics averaged across the five imputed datasets for the NICHD SECCYD are presented in Table 1 for both the full sample ($N = 1364$) and the subsample of individuals that provided information on the quality of their romantic relationships at age 15 ($n = 212$). A series of independent samples t-tests and chi-square likelihood ratio tests were conducted to determine if there were significant mean differences or distribution differences in variables between individuals who were missing romantic relationship quality data and those who had completed the assessment (analyses were conducted on the original unimputed dataset). Individuals who were involved with a romantic partner at age 15 had lower maternal education ($t = 3.66$, df = 1361, $p < .001$) and lower household income ($t = 4.60$, df = 1230, $p < .001$). Youth with romantic partners also had lower literacy skills in kindergarten ($t = 2.47$, df = 591, $p = .014$) and in middle childhood ($t = 4.09$, df = 1009, $p < .001$), lower friendship quality at 54 months ($t = 2.65$, df = 743, $p = .008$), higher conflict with teachers in middle childhood ($t = -3.14$, df = 1032, $p = .002$), and lower educational aspirations at age 15 ($t = 3.00$, df = 971, $p = .003$). Individuals who were African American ($\chi^2 = 9.08$, $p = .003$), had single mothers ($\chi^2 = 21.30$, $p < .001$), and

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had poorer self-regulation ($\chi^2 = 4.61$, $p = .032$) comprised a significantly larger proportion of the group of individuals with romantic partners at age 15. On the other hand, White children ($\chi^2 = 10.06$, $p = .002$) made up a significantly larger proportion of the group that reported not having a romantic partner at age 15.

Table 1: NICHD SECCYD Descriptive Statistics across Five Imputed Datasets

	Full Sample (N = 1364)				Romantic Relationship Subsample (n = 212)			
	Mean/%	SD	Min	Max	Mean/%	SD	Min	Max
Early Childhood Predictor								
Self-Regulation	0.51				0.45			
Early Childhood Covariates								
Child Male	0.52				0.46			
Child White/Other	0.81				0.73			
Child African American	0.13				0.19			
Child Hispanic	0.06				0.08			
Maternal Education	14.23	2.51	7.00	21.00	13.66	2.43	7.00	21.00
Household Income	53049.89	40500.95	1750.00	427000.33	41173.36	30289.77	1750.00	173333.67
Mother Married	0.77				0.64			
Literacy Ability	40.68	12.63	13.00	65.00	37.96	13.00	13.00	65.00
Peer Friendship Quality	78.85	7.70	43.00	99.00	77.49	8.28	54.00	98.00
Early Childhood Moderators								
Parent Closeness	22.49	2.15	11.00	25.00	22.60	2.16	14.00	25.00
Parent Conflict	23.26	6.73	10.00	46.00	23.79	7.20	10.00	46.00
Caregiver Closeness	20.49	3.50	5.00	25.00	20.66	3.46	8.00	25.00
Caregiver Conflict	16.95	5.75	10.00	42.00	16.68	5.45	10.00	37.00
Middle Childhood Mediators								
Parent Closeness	22.45	2.05	11.33	25.00	22.70	2.02	14.67	25.00
Parent Conflict	16.29	5.32	7.00	33.00	16.00	5.14	7.33	29.33
Teacher Closeness	18.97	2.84	8.33	25.00	18.80	2.92	8.33	25.00
Teacher Conflict	11.43	4.52	7.00	33.00	12.34	5.51	7.00	31.00
Middle Childhood Covariates								
Literacy Ability	35.76	8.70	10.00	50.00	34.22	9.22	12.00	50.00
Peer Friendship Quality	15.97	2.51	6.00	20.00	15.65	2.59	7.00	20.00
Adolescent Outcomes								
Reading Engagement	27.77	5.24	5.00	35.00	27.83	5.99	5.00	35.00
Math Engagement	25.34	5.85	5.00	35.00	25.35	6.41	6.00	35.00
School Completion	13.50	2.03	3.00	15.00	13.41	2.42	3.00	15.00
Romantic Relationship (Positive)					29.97	6.38	8.00	40.00
Romantic Relationship (Negative)					9.04	4.46	6.00	30.00

4.1.2 Self-Regulation predicting academic engagement and romantic relationship quality

Results for the analyses in which adolescent reports of academic engagement and romantic relationship quality at age 15 were regressed on a structured assessment of early childhood self-regulation at 54 months are presented in Table 2. For the academic engagement outcomes, self-regulation did not significantly predict adolescent reports of likelihood to finish school, literacy engagement, or math engagement after controlling for child gender, child race/ethnicity, household income, maternal marital status, maternal education, and literacy ability. Likewise, self-regulation at 54 months also did not significantly predict adolescent reports of positive and negative romantic relationship quality at age 15 after controlling for child gender, child race/ethnicity, household income, maternal marital status, maternal education, and peer friendship quality.

However, numerous demographic differences in adolescents' academic engagement and romantic relationship quality were detected. Males had fewer aspirations for completing school and reported less reading engagement and greater math engagement than females. No gender differences were detected for romantic relationship quality. African American youth were more likely to report higher aspirations for completing school, higher reading and math engagement, and greater negative romantic relationship quality than White adolescents. Hispanic adolescents were similar to their White peers on all outcomes with the exception of romantic relationship quality, in which they reported greater negativity in their relationships.

Adolescents whose mothers had a greater number of years of education at 54 months reported greater aspirations to complete school at age 15. Maternal education did not predict

reading engagement, math engagement, or positive and negative romantic relationship quality. Youth with mothers who were married at 54 months had greater aspirations for finishing school, more positive romantic relationship quality, and a trend toward less negative romantic relationship quality. Household income averaged across 24, 36, and 54 months did not significantly predict academic engagement or romantic relationship quality. Youth whose teachers rated them higher in literacy ability (average of 3rd and 5th grade reports), reported greater aspirations for completing school and greater reading and math engagement. Observer report of peer friendship quality in 4th grade negatively predicted positive romantic relationship quality, such that children with more positive interactions with peers reported less positivity in their romantic relationships. Peer friendship quality did not predict negative romantic relationship quality.

Table 2: NICHD SECCYD Early Childhood Self-Regulation Predicting Academic Engagement and Romantic Relationship Quality in Adolescence

	Adolescent Outcomes				
	School Completion B (SE)	Reading Engagement B (SE)	Math Engagement B (SE)	Pos. Rom. Relationship B (SE)	Neg. Rom. Relationship B (SE)
EC Predictor					
Self-Regulation	0.24 (0.14)	-0.11 (0.44)	0.17 (0.39)	0.04 (1.07)	0.49 (0.79)
Child Covariates					
Child Male	-0.52***(0.11)	-1.86***(0.36)	0.68* (0.33)	-0.46 (0.89)	0.06 (0.62)
Child African American	0.44* (0.20)	1.98** (0.56)	1.53* (0.61)	-0.41 (1.28)	1.97* (0.88)
Child Hispanic	-0.21 (0.27)	0.67 (0.67)	-0.23 (0.86)	0.51 (1.66)	2.31* (1.15)
Family Covariates					
Maternal Education	0.14***(0.03)	0.10 (0.11)	-0.09 (0.10)	-0.19 (0.21)	0.11 (0.15)
Marital Status	0.33* (0.16)	0.13 (0.59)	-0.28 (0.48)	3.04** (1.15)	-1.52† (0.84)
Household Income	0.00 (0.00)	0.00 (0.00)	0.01 (0.01)	-0.00 (0.02)	-0.01 (0.01)
MC Outcome Controls					

Literacy Ability	0.04* (0.01)	0.14***(0.02)	0.09** (0.03)
Friendship Quality		-0.46* (0.18)	-0.07 (0.13)

Note. Sample size for school completion, reading engagement, and math engagement models is 1364. Sample size for positive romantic relationship and negative romantic relationship models is 212.

$^†p < .10;$ $^*p < .05;$ $^{**}p < .01;$ $^{***}p < .001.$

4.1.3 Teacher-child and parent-child relationship quality mediator and moderator analyses for academic engagement

Given that the pathways between self-regulation and academic engagement were not significant (Pathway C: independent variable predicting dependent variable), no evidence for mediation was detected (refer to Figure 1). However, an indirect relationship could still exist between self-regulation and adolescent functioning (Rucker, Preacher, Tormala, & Petty, 2011), such that self-regulation could still significantly predict adult-child relationship quality (Pathway A: independent variable predicting mediator) and adult-child relationship quality could significantly predict academic engagement (Pathway B: mediator predicting dependent variable). Results for models testing the indirect pathways for teacher-child and parent-child relationship quality on academic engagement are presented in Table 3. Regression models for Pathway A detected only one significant pathway between early childhood self-regulation (54 months) and the quality of adult-child relationships in middle childhood. Self-regulation significantly, negatively predicted teacher conflict, such that children with greater self-regulation had less conflict with their teachers in middle childhood. The effect size for this link was .15, indicating that a one standard deviation increase in self-regulation was associated with a .15SD decrease in teacher conflict. For Pathway B, teacher conflict did not significantly predict school aspirations or reading

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engagement and only reached a trend toward significance for math engagement. No evidence emerged, therefore, for an indirect relationship between self-regulation and academic engagement via teacher-child conflict. Given that self-regulation was not related to parent-child closeness, parent-child conflict, or teacher-child closeness, additional indirect pathways were not examined.

The moderational influence of early childhood parent-child relationship quality and adolescent outcomes was also examined. Results for early childhood parent-child relationship quality at 54 months moderating the association between early childhood self-regulation and academic engagement in adolescence are also presented in Table 3. Contrary to hypotheses, parent-child closeness and conflict did not moderate the pathways between self-regulation and school aspirations, reading engagement, or math engagement.

Table 3: NICHD SECCYD Parent-Child and Teacher-Child Relationship Mediator and Moderator Models on Academic Engagement

	Middle Childhood Mediators (MR)				Adolescent Outcomes (DV)		
	Parent Close B (SE)	Parent Conflict B (SE)	Teacher Close B (SE)	Teacher Conflict B (SE)	School Completion B (SE)	Read Engagement B (SE)	Math Engagement B (SE)
Pathway A IV to MR							
Self-Regulation	-0.09 (0.15)	-0.32 (0.31)	0.02 (0.17)	-0.67** (0.25)			
Pathway B MR to DV							
Parent Close					0.06 (0.04)	0.19* (0.08)	0.02 (0.09)
Parent Conflict					-0.01 (0.01)	-0.02 (0.03)	-0.07* (0.03)
Teacher Close					0.08** (0.02)	0.04 (0.05)	0.18** (0.06)
Teacher Conflict					-0.01 (0.01)	-0.02 (0.04)	-0.09† (0.05)
Moderators							
P Close x Self-Reg					0.05 (0.05)	-0.11 (0.17)	0.15 (0.17)

			-0.03 (0.02)	-0.04 (0.05)	-0.09 (0.05)
P Conflict x Self-Reg					

Note. Child gender, child race/ethnicity, maternal education, maternal marital status, and household income were included as covariates in all models. Pathway A mediation analyses included teacher-child and parent-child relationship assessments at 54 months as covariates. Pathway B mediation analyses included literacy academic ability in kindergarten as an earlier control for academic engagement. Moderation analyses included literacy ability (average of 3rd and 5th grade) as an earlier outcome control.

$n = 1364.$

$^{\dagger}p < .10;\ ^{*}p < .05;\ ^{**}p < .01.$

4.1.4 Parent-child relationship quality mediator and moderator analyses with romantic relationship quality

As described in section 4.1.3, although the pathways between self-regulation and romantic relationship quality were not significant (Pathway C: dependent variable regressed on independent variable), an indirect relationship could still exist between self-regulation and romantic relationship quality via Pathway A (mediator regressed on independent variable) and Pathway B (dependent variable regressed on mediator). Results for parent-child relationship (mediator) in middle childhood mediating the association between early childhood self-regulation (independent variable) and romantic relationship quality (dependent variable) at age 15 are presented in Table 4 (refer to Figure 1 for conceptual framework). Regarding Pathway A, self-regulation did not predict parent-child closeness and conflict in middle childhood for the subsample of individuals involved in a romantic relationship (n = 212). Subsequently, findings for Pathway B were not detected; parent-child closeness and conflict in middle childhood was not associated with positive or negative romantic relationship characteristics in adolescence. Thus, an indirect relationship between self-regulation and romantic relationship quality was not evident.

Once again, the parent-child relationship in early childhood was examined as a potential moderator of the association between early childhood self-regulation and romantic relationship quality in adolescence. Findings are also presented in Table 4. Similar to the previous findings from section 4.1.3, parent-child closeness and conflict did not moderate the relationship between self-regulation and romantic relationship quality.

Table 4: NICHD SECCYD Parent-Child Relationship Mediator and Moderator Models on Romantic Relationship Quality

	Middle Childhood Mediators (MR)		Adolescent Outcomes (DV)	
	Parent Close	Parent Conflict	Positive Romantic Relationship	Negative Romantic Relationship
	B (SE)	B (SE)	B (SE)	B (SE)
Pathway A **IV to MR**				
Self-Regulation	0.03 (0.31)	-0.50 (0.71)		
Pathway B **MR to DV**				
Parent Close			0.15 (0.22)	-0.15 (0.15)
Parent Conflict			-0.10 (0.09)	0.05 (0.06)
Moderators				
P Close x Self-Reg			-0.33 (0.49)	0.15 (0.35)
P Conflict x Self-Reg			0.08 (0.14)	-0.16 (0.10)

Note. Child gender, child race/ethnicity, maternal education, maternal marital status, and household income were included as covariates in all models. Pathway A mediation analyses included parent-child relationship assessments at 54 months as covariates. Pathway B mediation analyses included peer friendship quality at 54 months as an earlier control for romantic relationship quality. Moderation analyses included peer friendship quality in 4th grade as an earlier outcome control.
$n = 212$.

4.1.5 Group-based trajectory analyses

Group-based trajectory analyses were conducted on teacher reports of self-regulation by age (in months) using semi-parametric modeling techniques in Stata 12 (Jones & Nagin, 2007; Jones & Nagin, 2012; Jones, Nagin, & Roeder, 2001). Data were modeled over six time points (kindergarten, grade 1, grade 3, grade 4, grade 5, and grade 6). Descriptive statistics are reported in Table 5. Self-regulation scores averaged around 15 (scores could range from 0 to 20) for each time point (sample size ranged from 842 to 1001). A total of 1129 individuals had self-regulation data for at least one of the six time points resulting in the final subsample used to model trajectories using maximum likelihood estimation. Independent samples t-tests and chi-square likelihood ratio tests were used to detect differences between individuals with trajectory data versus those missing data at all six time points (analyzed using original unimputed dataset). Only a few significant differences were found. For example, adolescents with trajectory group data had mothers with greater education ($t = $ -6.08, df $= 1361$, $p < .001$). In addition, African American children ($\chi^2 = 7.43$, $p = .006$) comprised a significantly larger proportion of the missing trajectory data group, while White children ($\chi^2 = 5.32$, $p = .021$) made up a greater proportion of the group with trajectory data.

Table 5: NICHD SECCYD Descriptive Statistics for Teacher Rated Self-Regulation

	Kindergarten (n=993)	Grade 1 (n=1001)	Grade 3 (n=975)	Grade 4 (n=906)	Grade 5 (n=921)	Grade 6 (n=842)
Mean	15.18	15.17	14.90	15.00	15.03	15.28
SD	3.71	3.71	3.97	3.88	3.99	3.73
Min	1.00	3.00	2.00	2.00	2.00	2.00
Max	20.00	20.00	20.00	20.00	20.00	20.00

Models were estimated using censored normal multiple regression. The number of groups and model selection were determined using a two-step procedure outlined by Nagin (2005) and summarized in Table 6. For the first step different numbers of groups were extracted, starting at one, with the number of groups increasing consecutively by one until a group maximum predetermined by the researcher was reached. The function assigned to each group was held to a pre-established pattern for each extraction. Given that past research has shown that a substantial proportion of the population is found to be relatively stable in self-regulation development over time (Hay & Forrest, 2006), the pattern was set so that for each extraction, one group was fixed as a constant while the remaining groups were set to model a quadratic function. This decision was based on Nagin's (2005) previous work for a similar behavioral phenomenon (aggressive behaviors) which demonstrates stability in a large sector of the population over time. The BIC was then used to calculate the Bayes' factor approximation (Kass & Wasserman, 1995; Schwarz, 1978) to determine whether the more complex model (larger number of groups) was a significant improvement over the less complex model (smaller number of groups), using Jeffrey's scale of evidence for Bayes' factors (reported in Nagin, 2005). According to these procedures (and shown in Table 6), a four-group model was considered the best fit for the data.

Table 6: NICHD SECCYD Selecting Number of Trajectory Groups and Model Fit with BIC

Number of Groups	BIC (n=1129)	BIC (n=5638)	Null Model	Bays' Factor Approximation	Evidence Against Null Model
1	-15172.72	-15174.33			
2	-14603.90	-14608.72	1	4.38e+245	Strong
3	-14546.80	-14554.84	2	2.51e+23	Strong
4	-14525.37	-14536.63	3	8.10e+7	Strong
5	-14528.42	-14542.90	4	0.00	Weak
Four Group Model					
(0,2,2,0)	-14533.49	-14543.13			
(1,2,2,0)	-14529.87	-14540.32	(0,2,2,0)	16.61	Strong

(2,2,2,0)	-14525.37	-14536.63	(1,2,2,0)	40.04	Strong
(2,2,1,0)	-14522.59	-14533.05	(2,2,2,0)	35.87	Strong
(2,1,1,0)	-14521.80	-14531.45	(2,2,1,0)	4.95	Moderate

Note. 0 = Constant; 1 = Linear; 2 = Quadratic.

The second step determined the appropriate function for each of the four groups. The procedures from the first step were also used to compare potential models. As described in both Tables 6 and 7, the final model was comprised of four groups: one with a quadratic function (*Low Curvilinear*), one with a positive linear trajectory (*Medium Increasing*), one with a negative linear trajectory (*Medium Decreasing*), and one set as a constant (*High Stable*). The *Low Curvilinear* group (see Figure 3) was estimated to comprise approximately 6.7% of the sample, with a baseline self-regulation score of 11.6 at 67 months (5.5 years). Their scores decreased steadily from 67 to 107 months (9 years), plateaued from 107 to 118 months (10 years), and then steadily began to increase from about 118 to 142 months (12 years). The *Medium Increasing* group was estimated to comprise approximately 15.6% of the sample, with a baseline score of 10.75. The group steadily increased in self-regulation from 67 months (5.5 years) to 142 months (12 years). The *Medium Decreasing* group contained approximately 13.2% of the sample, with a baseline self-regulation score of 14.9. The group steadily declined in self-regulation over time. The *High Stable* group comprised the largest estimated proportion of the sample, which was 64.5%. The baseline score was 16.9 and remained relatively stable over time. This is noteworthy given that the range is 0 to 20, and between one and six teachers rated them over this time period.

Table 7: NICHD SECCYD Censored Multiple Regression of Self-Regulation Score by Age (in Months) for each Trajectory Group.

Groups		**B**	**SE**	**t**	**P**
Low Curvilinear	Intercept	11.57	0.53	21.85	<.001
	Linear	-0.17	0.03	-5.52	<.001
	Quadratic	0.00	0.00	4.61	<.001

Medium Increasing	Intercept	10.75	0.40	27.13	<.001
	Linear	0.05	0.01	6.59	<.001
Medium Decreasing	Intercept	14.88	0.43	34.88	<.001
	Linear	-0.06	0.01	-6.18	<.001
High Stable	Intercept	16.90	0.07	246.01	<.001
	Sigma	3.12	0.03	90.94	<.001
	Group membership				
Low Curvilinear	(%)	6.67	1.22	5.48	<.001
Medium Increasing	(%)	15.64	2.34	6.67	<.001
Medium Decreasing	(%)	13.18	2.26	5.83	<.001
High Stable	(%)	64.50	1.95	33.10	<.001

Individual students were assigned to each of the four groups using the maximum posterior probability rule. Average assignment probabilities for each group are listed in Table 8 and descriptive statistics for each group are provided in Table 9. The total number of individuals classified into the *Low Curvilinear* group was 72 (6.4%) and the average posterior probability for individuals classified into this group was .82. Nagin (2005) considers the average posterior probability acceptable if it is above .70. The *Low Curvilinear* group consisted mainly of boys (72%) and a relatively even distribution of minority - African American and Hispanic (49%) - and White (51%) children. Youth in this group were also more likely to be low-income (average income was $27,201.45) and raised by single mothers (62%) during early childhood.
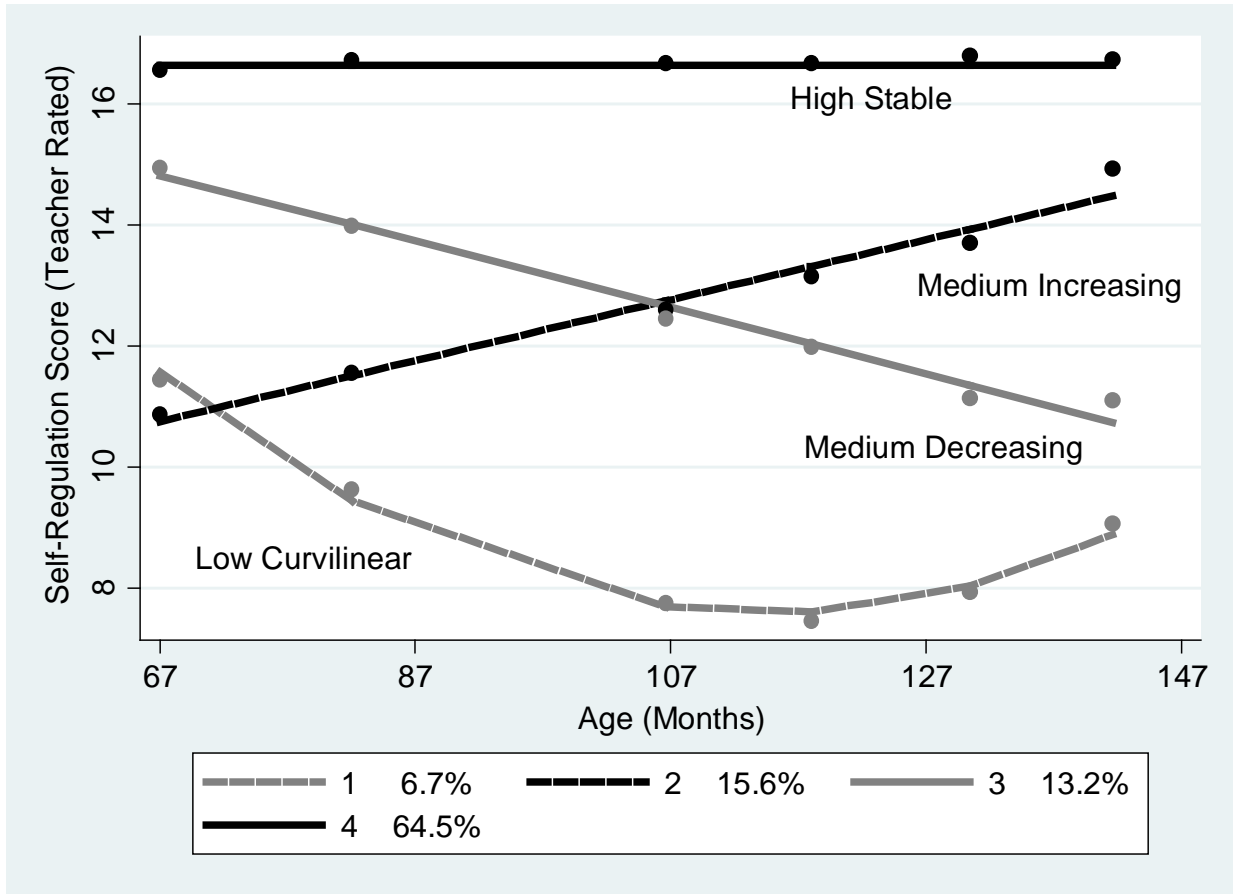
Figure 3: NICHD SECCYD Self-Regulation Trajectories (n = 1129)

A total of 170 (15.1%) adolescents were placed into the *Medium Increasing* group with an average assignment probability of .74 for adolescents placed in this group. Youth in the *Medium Increasing* group were more likely to be male (59%), White (76% versus 16% for African American and 8% for Hispanic), middle-income (average income was $47,135.96), and reared by two married parents (69%) during early childhood.

Table 8: NICHD SECCYD Average Assignment Probabilities based on Maximum Posterior Probability Rule

		Group				
Assigned	Number	Low	Medium	Medium	High	Range

Group	Assigned	Curvilinear	Increasing	Decreasing	Stable	
Low Curvilinear	72	.82	.07	.11	.00	.39-1.00
Medium Increasing	170	.04	.74	.13	.08	.35-1.00
Medium Decreasing	129	.06	.14	.72	.08	.34-1.00
High Stable	758	.00	.04	.03	.93	.33-1.00

The third group, *Medium Decreasing*, had a total of 129 (11.4%) individuals classified into it, with an average posterior probability of .72. Similar to *Medium Increasing,* the *Medium Decreasing* group also contained mostly boys (69%) and White children (71% versus 19% for African American and 9% for Hispanic). Household composition for this group consisted mainly of middle-income (average income was $43,266.49) and married families (64%).

A total of 758 (67.1%) youth were classified into *High Stable*, the largest of the four groups. The average posterior probability was .93 for individuals classified into this group. The *High Stable* group was mostly girls (55%) and White children (89% versus 6% for African American and 5% for Hispanic). Their parents were also more likely to be middle-income (average income was $59,194.09) and married (83%) during early childhood.

Table 9: NICHD SECCYD Descriptive Statistics for Trajectory Groups

	Full Sample (n=1129)		Low Curvilinear (n=72)	Medium Increasing (n=170)	Medium Decreasing (n=129)	High Stable (n=758)
	Mean/% (SD)	Min, Max	Mean/% (SD)	Mean/% (SD)	Mean/% (SD)	Mean/% (SD)
Early Childhood Covariates						
Child Male	0.51		0.72	0.59	0.69	0.45
Child White/Other	0.82		0.51	0.76	0.71	0.89
Child African American	0.12		0.43	0.16	0.19	0.06
Child Hispanic	0.06		0.06	0.08	0.09	0.05
Maternal Education	14.42 (2.47)	7.00, 21.00	12.76 (2.20)	14.00 (2.33)	13.63 (2.45)	14.81 (2.42)

	Reduced Sample		Low Curvilinear	Medium Increasing	Medium Decreasing	High Stable
Household Income	53518.26 (41392.81)	1750.00, 427000.33	27201.45 (19709.59)	47135.96 (35018.36)	43266.49 (44583.75)	59194.09 (42207.65)
Mother Married	0.76		0.38	0.69	0.64	0.83
Middle Childhood Covariates						
Literacy Ability	36.46 (8.68)	10.00, 50.00	27.86 (9.82)	33.81 (8.59)	33.07 (9.07)	38.46 (7.63)
Peer Friendship Quality	15.94 (2.55)	6.00, 20.00	14.79 (2.92)	15.42 (2.60)	15.61 (2.72)	16.23 (2.42)
Adolescent Outcomes						
Reading Engagement	27.93 (5.33)	5.00, 35.00	27.75 (5.56)	27.79 (5.10)	26.60 (5.73)	28.20 (5.26)
Math Engagement	25.43 (5.88)	5.00, 35.00	25.94 (6.10)	25.20 (6.13)	24.80 (6.20)	25.54 (5.75)
School Completion	13.67 (2.03)	3.00, 15.00	12.81 (2.58)	13.38 (2.14)	13.27 (2.33)	13.88 (1.85)

	Reduced Sample (n=209)		Low Curvilinear (n=22)	Medium Increasing (n=30)	Medium Decreasing (n=32)	High Stable (n=125)
	Mean/% (SD)	Min, Max	Mean/% (SD)	Mean/% (SD)	Mean/% (SD)	Mean/% (SD)
Adolescent Outcomes						
Romantic Relationship (Positive)	29.95 (6.42)	8.00, 40.00	30.18 (7.93)	29.27 (7.70)	28.16 (6.71)	30.54 (5.67)
Romantic Relationship (Negative)	9.04 (4.46)	6.00, 30.00	9.86 (6.19)	8.87 (3.10)	10.88 (5.58)	16.23 (3.93)

4.1.6 Demographic predictors of self-regulation group trajectory membership

Multinomial logistic regression analyses were conducted to determine whether child gender, maternal education, household income, and child race/ethnicity would significantly predict self-regulation trajectory group membership. Coefficients, standard errors, and relative risk ratios (RR) for significant pathways are presented in Table 10. Youth in the *High Stable* group were more likely to be girls, White, have higher maternal education, and higher household income, than the other three groups. Boys were 4 times more likely to be classified as *Low Curvilinear,* 2 times more likely to be classified as *Medium Increasing,* and 3 times more likely to be classified as *Medium Decreasing* than *High Stable*. As years of maternal education increased, youth were

significantly less likely to be grouped into *Low Curvilinear*, *Medium Increasing*, and *Medium Decreasing*. In other words, a one unit increase in maternal education was associated with a 9-17% reduced risk of classification into the *Low Curvilinear*, *Medium Increasing*, or *Medium Decreasing* groups as opposed to the *High Stable* group. Similarly, as household income increased, youth were also less likely to be classified as *Low Curvilinear* (2% reduced risk per one unit increase in household income) than as *High Stable*, however no differences between *High Stable* and *Medium Increasing* or *Medium Decreasing* were detected. African American adolescents were 7 times more likely to be classified into *Low Curvilinear* and 3 times more likely to be classified into *Medium Increasing* or *Medium Decreasing* than their White peers.

Child gender, household income, and child African American also differentiated between classification in *Low Curvilinear* relative to *Medium Increasing* and *Medium Decreasing,* such that youth in the *Low Curvilinear* group were more likely to be boys, African American, and have lower household incomes. Compared to girls, boys were significantly less likely (51% reduced risk) to be grouped into the *Medium Increasing* group than the *Low Curvilinear* group. As household income increased, adolescents were more likely to be members of both the *Medium Increasing* group and the *Medium Decreasing* group than the *Low Curvilinear* group (a one unit increase in income associated with 1.02 times the risk). Compared to White youth, African American youth were also less likely to be classified in the *Medium Increasing* (61% reduced risk) and *Medium Decreasing* (54% decrease in risk) groups. Maternal education did not differentiate between *Low Curvilinear* and the *Medium Increasing* and *Medium Decreasing* groups.

Finally, when contrasting the *Medium Increasing* and *Medium Decreasing* groups, only gender emerged as a possible predictor of group membership. Boys were twice as likely as girls

to be grouped into *Medium Decreasing* than *Medium Increasing*, although this association only reached a trend toward significance. Across all models, White and Hispanic youth did not differ in likelihood of self-regulation trajectory group classification.

Table 10: NICHD SECCYD Multinomial Logistic Regression with Demographic Predictors of Self-Regulation Group Trajectory Membership

	Child and Family Predictors								
	Child Male		**Maternal Education**		**Household Income**		**Child African American**		**Child Hispanic**
	B (SE)	RR	B (SE)	RR	B (SE)	RR	B (SE)	RR	B (SE)
High Stable									
Low Curvilinear	1.32*** (0.29)	3.74	-0.19* (0.07)	0.83	-0.02** (0.01)	0.98	1.91*** (0.32)	6.75	0.17 (0.57)
Medium Increasing	0.60** (0.17)	1.82	-0.09* (0.04)	0.91	-0.00 (0.00)		0.97*** (0.27)	2.64	0.36 (0.34)
Medium Decreasing	1.06*** (0.21)	2.89	-0.14** (0.05)	0.87	-0.00 (0.00)		1.14*** (0.29)	3.13	0.55 (0.36)
Low Curvilinear									
Medium Increasing	-0.72* (0.32)	0.49	0.10 (0.08)		0.02* (0.01)	1.02	-0.94** (0.34)	0.39	0.19 (0.61)
Medium Decreasing	-0.27 (0.33)		0.04 (0.08)		0.02* (0.01)	1.02	-0.77* (0.35)	0.46	0.38 (0.62)
Medium Increasing									
Medium Decreasing	0.46† (0.25)	1.58	-0.06 (0.06)		-0.00 (0.00)		0.17 (0.32)		0.19 (0.43)

$n = 1129$.
$^{†}p < .10$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

4.1.7 Self-regulation trajectory groups predicting academic engagement and romantic relationship quality

Results examining the association between self-regulation group trajectory membership and academic engagement and romantic relationship quality in adolescence are presented in Table 11. School aspirations and math engagement were comparable across all four groups, and adolescent outcomes did not vary significantly between the *High Stable* and *Medium Increasing* groups, between the *High Stable* and *Low Curvilinear* groups, or between the *Low Curvilinear*

and *Medium Increasing* groups. There was one difference detected at trend level between the *Low Curvilinear* group and the *High Stable* group, such that youth in the *Low Curvilinear* group reported greater reading engagement relative to individuals classified in the *High Stable* group. Most of the differences, therefore, emerged between the *Medium Decreasing* group and the other three groups, with youth in the *Medium Decreasing* group demonstrating poorer outcomes. Adolescents in the *Medium Decreasing* group reported less positive and more negative romantic relationship quality than youth in the *High Stable* group. Additionally, youth classified in the *Medium Decreasing* group had lower reading engagement relative to youth in the *Low Curvilinear* group, and a trend toward more negative romantic relationship characteristics than youth in the *Medium Increasing* group.

Table 11: NICHD SECCYD Self-Regulation Trajectory Groups Predict Academic Engagement and Romantic Relationship Quality

	Adolescent Outcomes				
	School Completion	**Reading Engagement**	**Math Engagement**	**Positive Romantic Relationship**	**Negative Romantic Relationship**
	B (SE)	**B (SE)**	**B (SE)**	**B (SE)**	**B (SE)**
High Stable					
Low Curvilinear	-0.13 (0.26)	1.29† (0.71)	0.62 (0.84)	-0.14 (1.66)	0.38 (1.15)
Medium Increasing	-0.09 (0.19)	0.48 (0.46)	-0.17 (0.71)	-1.32 (1.34)	-0.21 (0.92)
Medium Decreasing	-0.04 (0.21)	-0.41 (0.52)	-0.64 (0.61)	-2.50† (1.38)	1.96* (0.95)
Low Curvilinear					
Medium Increasing	0.04 (0.28)	-0.81 (0.75)	-0.80 (0.98)	-1.18 (1.84)	-0.59 (1.26)
Medium Decreasing	0.09 (0.30)	-1.70* (0.78)	-1.26 (0.92)	-2.36 (1.78)	1.58 (1.22)
Medium Increasing					
Medium Decreasing	0.05 (0.23)	-0.89 (0.59)	-0.46 (0.90)	-1.18 (1.65)	2.17† (1.13)

Note. Child gender, child race/ethnicity, maternal education, maternal marital status, and household income were included as covariates in all models. Literacy academic ability in middle childhood (average of 3rd and 5th grade) and peer friendship quality in middle childhood (4th

relationship quality.

$n = 1129$ for academic engagement models.

$n = 209$ for romantic relationship quality models.

$^{\dagger}p < .10;\ ^{*}p < .05.$

4.2   STUDY 2: PMCP FINDINGS

4.2.1   Descriptive statistics

Descriptive Statistics averaged across the five imputed datasets for the PMCP are presented in Table 12 for both the full sample ($n = 314$) and the subsample of individuals that provided information on the quality of their romantic relationships at age 20 ($n = 133$). Similar to the procedures used for the NICHD SECCYD, sample mean and distribution differences between individuals involved with a romantic partner at age 20 and those who were romantically unattached, were examined using independent samples t-tests and chi-square likelihood ratio testes (analyses conducted on original unimputed dataset). For the PMCP, no significant group differences were detected.

Table 12: PMCP Descriptive Statistics across Five Imputed Datasets

	Full Sample (N = 314)				Romantic Relationship Subsample (n = 133)			
	Mean/%	SD	Min	Max	Mean/%	SD	Min	Max
Early Childhood Emotional Regulation								
Active Distraction	10.68	5.08	0.00	18.00	10.89	5.08	0.00	18.00
Task Focus	4.51	4.30	0.00	18.00	4.71	4.50	0.00	17.00
Early Childhood Covariates								
Child White	0.51				0.48			
Child African American	0.39				0.43			
Child Hispanic/Other	0.10				0.09			
Maternal Education	12.76	1.48	8.00	18.00	12.66	1.45	9.00	16.00
Household Income	18228.16	10679.05	4632.00	65324.00	17137.96	9677.25	4836.00	54000.00

Mother Married	.43				0.38			
Early Childhood Moderators								
Parent Closeness	21.75	2.78	9.00	25.00	21.48	2.88	9.00	25.00
Parent Conflict	23.33	7.81	10.00	47.00	23.99	8.33	10.00	46.00
Teacher Closeness	18.26	3.99	7.00	25.00	18.71	4.19	7.00	25.00
Teacher Conflict	17.86	7.86	10.00	49.00	17.68	7.85	10.00	45.00
Middle Childhood Mediators								
Parent Closeness	21.48	2.93	5.00	25.00	21.62	2.76	12.33	25.00
Parent Conflict	20.78	7.24	10.00	46.00	20.43	7.23	10.00	46.00
Teacher Closeness	15.85	3.97	6.00	25.00	15.79	3.68	6.00	25.00
Teacher Conflict	19.44	8.04	10.00	43.00	19.18	7.90	10.00	42.00
Outcome Covariates								
Scholastic Competence	12.52	2.58	5.00	16.00	12.81	2.55	6.00	16.00
Proactive Aggression	1.52	1.77	0.00	9.00	1.48	1.78	0.00	7.00
Peer Friendship Quality	12.55	2.10	3.00	15.00	12.59	2.10	6.00	15.00
Adolescent Outcomes								
School Completion								
High School/GED/or less	0.16				0.14			
Associate's/Bachelor's	0.69				0.73			
Graduate Degree	0.15				0.13			
Organizational Workplace Behaviors	9.76	10.63	0.00	73.00	8.34	8.78	0.00	42.00
Interpersonal Workplace Behaviors	4.07	5.94	0.00	43.00	3.28	4.95	0.00	22.00
Romantic Relationship Quality					20.95	4.63	5.00	25.00

4.2.2 Self-Regulation predicting academic engagement, romantic relationship quality, and workplace behaviors

Findings for analyses in which adolescent romantic relationship quality and workplace behaviors at age 20 were regressed onto two assessments of self-regulation at 42 months are presented in Table 13, while multinomial logistic regression analyses for self-regulation predicting academic engagement are displayed in Table 14. Across both tables, Model 1 presents results for total distraction and Model 2 presents findings for total object focus as behavioral measures of self-regulation. Total distraction and total object focus did not significantly predict organizational and interpersonal workplace behaviors (see Table 13). Likewise, total distraction and total object

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focus did not significantly predict adolescent reports of romantic relationship quality (see Table

13) or academic engagement at age 20 (see Table 14).

Table 13: PMCP Early Childhood Self-Regulation Predicting Workplace Behaviors and Romantic Relationship Quality in Adolescence

	Organizational Workplace Behaviors		Interpersonal Workplace Behaviors		Romantic Relationship Quality	
	Model 1 B (SE)	Model 2 B (SE)	Model 1 B (SE)	Model 2 B (SE)	Model 1 B (SE)	Model 2 B (SE)
EC Predictor						
Total Distraction	0.14 (0.16)		0.10 (0.08)		-0.04 (0.08)	
Total Object Focus		-0.20 (0.17)		-0.03 (0.09)		0.04 (0.09)
Child Covariates						
Child African American	-2.55† (1.54)	-2.65† (1.55)	-1.53 (0.96)	-1.60 (0.96)	-0.54 (0.97)	-0.49 (0.97)
Child Hispanic/Other	0.11 (2.46)	-0.03 (2.45)	0.48 (1.46)	0.41 (1.47)	-1.67 (1.58)	-1.50 (1.55)
Family Covariates						
Maternal Education	1.31** (0.45)	1.33** (0.45)	0.44† (0.24)	0.43† (0.24)	-0.21 (0.29)	-0.22 (0.29)
Mother Married	0.17 (1.53)	0.12 (1.53)	0.21 (0.86)	0.22 (0.86)	-0.45 (0.99)	-0.42 (0.99)
Household Income	0.01 (0.07)	0.01 (0.07)	0.07† (0.04)	0.07† (0.04)	0.08 (0.05)	0.08 (0.05)
Outcome Controls						
Proactive Aggression	0.33 (0.37)	0.33 (0.37)	0.03 (0.19)	0.02 (0.19)		
Peer Friendship (Positive)					0.17 (0.28)	0.18 (0.28)

Note. Sample size for organizational and interpersonal workplace behaviors is 314. Sample size for romantic relationship quality is 133.
$^\dagger p < .10$; $^{**}p < .01$.

Across all models, demographic predictors (child race/ethnicity, maternal education, maternal marital status, and household income) and outcome controls (proactive aggression, peer friendship quality, and scholastic competence) were entered as predictors of adolescent

behaviors. Child race/ethnicity did not significantly predict adolescent functioning. However, a trend was detected for organizational workplace behaviors, such that African American youth compared to White youth reported lower organizational deviance. Maternal education was associated with workplace behaviors and academic engagement, but not romantic relationship quality. Adolescents with mothers with greater years of education at 42 months reported greater organizational and interpersonal workplace deviance, although the latter pathway only reached a trend level. An additional trend toward significance for maternal education emerged such that as maternal education increased youth were more likely to report desiring a graduate degree versus a high school diploma, GED, or less, and desiring a graduate degree compared to a Bachelor's or Associate's degree.

Table 14: PMCP Multinomial Logistic Regression with Early Childhood Self-Regulation Predicting Academic Engagement

	HS/GED/or less		Associate's or Bachelor's	HS/GED/or less		Associate's or Bachelor's
	Associate's or Bachelor's Model 1a B (SE)	Graduate Degree Model 1b B (SE)	Graduate Degree Model 1c B (SE)	Associate's or Bachelor's Model 2a B (SE)	Graduate Degree Model 2b B (SE)	Graduate Degree Model 2c B (SE)
EC Predictors						
Total Distraction	0.03 (0.04)	0.03 (0.05)	0.00 (0.04)			
Total Object Focus				-0.02 (0.05)	-0.07 (0.06)	-0.05 (0.05)
Child Covariates						
Child African American	-0.35 (0.48)	-0.63 (0.58)	-0.27 (0.49)	-0.36 (0.47)	-0.64 (0.58)	-0.27 (0.49)
Child Hispanic/Other	-0.41 (0.61)	-0.58 (1.02)	-0.18 (0.84)	-0.44 (0.60)	-0.63 (1.01)	-0.19 (0.86)
Family Covariates						
Maternal Education	0.17 (0.17)	0.41[†] (0.20)	0.24[†] (0.12)	0.17 (0.17)	0.41[†] (0.20)	0.24[†] (0.12)

Mother Married	-0.79† (0.46)	-1.05† (0.57)	-0.26 (0.51)	-0.78† (0.46)	-1.07† (0.57)	-0.29 (0.51)
Household Income	0.06† (0.03)	0.09* (0.04)	0.03 (0.02)	0.06† (0.03)	0.09* (0.04)	0.03 (0.02)
Outcome Controls						
Scholastic Competence	0.07 (0.10)	0.28* (0.12)	0.22* (0.09)	0.07 (0.10)	0.28* (0.12)	0.21* (0.09)

Note. Sample size is 314.
†$p < .10$; *$p < .05$.

Maternal marital status at 42 months did not significantly predict workplace behaviors or romantic relationship quality, but did reach a trend level for academic engagement. Youth with mothers who were married at 42 months were less likely to desire an Associate's or Bachelor's versus a high school diploma, GED, or less, and less likely to desire a graduate degree versus a high school diploma, GED, or less. Annual household income (averaged across 42 months, 60 months, and 72 months) also did not predict organizational workplace behaviors, but reached a positive trend toward significance for interpersonal workplace behaviors and academic engagement. As annual household income increased, youth were more likely to report desiring an Associate's or Bachelor's degree and a graduate degree versus a high school diploma, GED, or less (the latter association actually reached significance).

Among the outcome controls, only scholastic competence at age 12 predicted academic engagement at age 20. As scholastic competence increased youth reported a greater desire for obtaining a graduate degree versus a high school diploma, GED, or less and a greater desire for a graduate degree versus an Associate's or Bachelor's degree. Proactive aggression at 72 months and peer friendship quality at age 17 were not related to workplace deviancy or romantic relationship quality, respectively.

4.2.3 Teacher-child and parent-child relationship quality mediator and moderator analyses for academic engagement and workplace behaviors

Because the pathways between self-regulation and academic engagement and workplace behaviors (Pathway C: independent variables predicting dependent variables) were not significant, evidence for mediation was not supported. However, even though Pathway C was not significant, an indirect relationship could still exist between self-regulation and adolescent functioning (Rucker et al., 2011), such that self-regulation could still predict adult-child relationship quality (Pathway A: independent variables predicting mediators) and adult-child relationship quality could predict academic engagement and workplace behaviors (Pathway B: mediators predicting dependent variables). Results for these indirect pathways are presented in Tables 15 and 16 (refer to Figure 1 for conceptual model). For the regressions modeling Pathway A no significant associations were detected. Thus, an indirect relationship between self-regulation and academic engagement or between self-regulation and workplace behaviors was not supported by the data.

Table 15: PMCP Parent-Child and Teacher-Child Relationship Mediator and Moderator Models on Academic Engagement

					Adolescent Outcomes					
	Mediators (MR)				HS/GED/or less	Assoc. or Bach.	HS/GED/or less		Assoc. or Bach.	
	Parent Close	Parent Conflict	Teacher Close	Teacher Conflict	Assoc. or Bach	Graduate Degree	Graduate Degree	Assoc. or Bach	Graduate Degree	Graduate Degree
					Total Distraction			Total Object Focus		
	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)
Pathway A **IV to MR**										
Total Distraction	-0.01 (0.04)	-0.13 (0.08)	0.03 (0.05)	0.08 (0.10)						
Total Object Focus	0.01 (0.04)	0.14 (0.10)	0.02 (0.05)	-0.02 (0.14)						
Pathway B **MR to DV**										

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		1	2	3	4	5	6
Parent Close		0.01 (0.07)	-0.02 (0.12)	-0.03 (0.09)	0.01 (0.07)	-0.02 (0.12)	-0.03 (0.09)
Parent Conflict		0.00 (0.02)	0.02 (0.04)	0.02 (0.03)	-0.00 (0.02)	0.02 (0.04)	0.02 (0.04)
Teacher Close		0.00 (0.06)	0.10 (0.08)	0.09 (0.06)	0.01 (0.06)	0.10 (0.08)	0.09 (0.06)
Teacher Conflict		-0.03 (0.03)	-0.08* (0.04)	-0.05 (0.03)	-0.03 (0.03)	-0.08* (0.04)	-0.05 (0.03)
Moderators							
P Close x Self-Reg		-0.00 (0.01)	-0.00 (0.02)	-0.00 (0.01)	-0.00 (0.02)	-0.00 (0.02)	0.00 (0.02)
P Conflict x Self-Reg		-0.00 (0.01)	-0.00 (0.01)	-0.00 (0.01)	0.00 (0.00)	-0.00 (0.01)	-0.00 (0.01)

Note. Child race/ethnicity, maternal education, maternal marital status, and household income were included as covariates in all models. Moderation analyses included scholastic competence at age 12 as an earlier control for academic engagement.

n = 314.

*$p < .05$.

Findings for early childhood parent-child relationship quality at 72 months moderating the relationship between early childhood self-regulation (42 months) and academic engagement and workplace behaviors at age 20 are also presented in Tables 15 and 16. Contrary to hypotheses, parent-child closeness and conflict in middle childhood did not moderate the association between self-regulation (total distraction and total object focus) and educational aspirations and workplace deviancy.

Table 16: PMCP Parent-Child Relationship Mediator and Moderator Models on Workplace Behaviors

	Organizational Workplace		Interpersonal Workplace Behaviors	
	Total Distraction	**Total Object Focus**	**Total Distraction**	**Total Object Focus**
	B (SE)	**B (SE)**	**B (SE)**	**B (SE)**
Pathway B MR to DV				
Parent Close	-0.36 (0.26)	-0.36 (0.26)	-0.19 (0.16)	-0.20 (0.17)
Parent Conflict	0.16 (0.10)	0.17 (0.10)	0.10† (0.05)	0.09† (0.05)
Moderators				

P Close x Self-Reg	-0.04 (0.05)	0.03 (0.06)	-0.03 (0.02)	0.02 (0.03)
P Conflict x Self-Reg	0.02 (0.02)	-0.02 (0.02)	0.01 (0.01)	-0.01 (0.01)

Note. Child race/ethnicity, maternal education, maternal marital status, and household income were included as covariates in all models. Moderation analyses included proactive aggression at 72 months as an earlier control for workplace behaviors.

n = 314.

[†]$p < .10$.

4.2.4 Parent-child relationship quality mediator and moderator analyses for romantic relationship quality

Similar to the findings from section 4.2.3, even though self-regulation did not predict romantic relationship quality (Pathway C: independent variables predicting dependent variable), Pathway A (parent-child relationship quality regressed on self-regulation) and Pathway B (romantic relationship quality regressed on parent-child relationship quality) were examined to determine if an indirect effect still existed between self-regulation and romantic relationship quality (refer to Figure 1). Results for these indirect pathways are presented in Table 17. Once again, total distraction and total object focus did not predict parent closeness or parent conflict in middle childhood (Pathway A: mediators regressed on independent variables). Given the nonsignificant findings for Pathway A, no further tests for indirect effects were necessary.

Parent-child relationship quality (reported at 72 months) moderational analyses are also reported in Table 17. Similar to the previous findings for academic engagement and workplace behaviors, parent-child closeness and conflict did not significantly moderate the associations between self-regulation (total object focus and total distraction) and romantic relationship quality.

Table 17: PMCP Parent-Child Mediator and Moderator Models with Romantic Relationship Quality

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	Mediators (MR)		Romantic Relationship Quality	
	Parent Close B (SE)	Parent Conflict B (SE)	Total Distraction B (SE)	Total Object Focus B (SE)
Pathway A **IV to MR**				
Total Distraction	-0.00 (0.06)	-0.06 (0.13)		
Total Object Focus	-0.02 (0.06)	0.06 (0.14)		
Pathway B **MR to DV**				
Parent Close			0.15 (0.16)	0.15 (0.16)
Parent Conflict			0.04 (0.06)	0.04 (0.06)
Moderators				
P Close x Self-Reg			0.00 (0.03)	-0.01 (0.03)
P Conflict x Self-Reg			0.01 (0.01)	-0.01 (0.01)

Note. Child race/ethnicity, maternal education, maternal marital status, and household income were included as covariates in all models. Moderation analyses included peer friendship quality at age 17 as an earlier control for romantic relationship quality.
n = 133.

4.2.5 Group-based trajectory analyses

Similar to the previous findings from the NICHD SECCYD, group-based trajectory analyses were conducted on teacher reports of self-regulation by age (in months) using semi-parametric modeling techniques in Stata 12 (Jones & Nagin, 2007; Jones & Nagin, 2012; Jones, Nagin, & Roeder, 2001). Data were modeled over five time points (6, 7, 8, 11, and 12 years of age). Descriptive statistics are reported in Table 18. Teacher-rated self-regulation scores averaged around 13 for all five time points (potential scores ranged from 0 to 20) and sample sizes ranged from 124 to 200 students. A total of 267 individuals had self-regulation data for at least one of the five time points resulting in the final subsample used to model trajectories over time. A

series of independent samples t-tests and chi-square likelihood ratio tests were conducted to examine differences between the subsample of individuals with self-regulation trajectory data and the subsample of individuals missing trajectory data (analyses conducted using original unimputed dataset). Only one significant group difference emerged. Household income was higher for youth missing trajectory data ($t = 2.37$, df = 300, $p = .018$).

Table 18: PMCP Descriptive Statistics for Teacher Rated Self-Regulation Score

	6 Years (n=200)	7 Years (n=174)	8 Years (n=153)	11 Years (n=124)	12 Years (n=155)
Mean	13.17	13.28	13.39	12.69	13.21
SD	4.54	4.28	4.60	4.61	4.02
Min	0.00	1.00	2.00	1.00	3.00
Max	20.00	20.00	20.00	20.00	20.00

Group-based trajectory models were estimated using censored normal multiple regression. The number of groups and model selection were determined using the same two-step procedure outlined by Nagin (2005) and described in section 4.1.5 for the NICHD SECCYD. According to these procedures (summarized in Table 19), a three-group model emerged as the best fit for the data: one group with a quadratic function (*Low Curvilinear*), and the other two groups set as constants (*Medium Stable* and *High Stable*). The *Low Curvilinear* group (see Table 20 and Figure 4) was estimated to comprise approximately 15.2% of the sample, with a baseline self-regulation score of 8.08 at 72 months (6 years). Their scores decreased steadily from 72 months to approximately 95 months (8 years), then increased steadily from 95 to 130 months (11 years), and then increased more sharply from 130 to 145 months (12 years). The *Medium Stable* group was estimated to comprise approximately 43.5% of the sample, with a baseline score of 12.17 which remained relatively stable over the five time points. The *High Stable* group

contained approximately 41.4% of the sample. The baseline score was 16.16, which remained

relatively stable over time.

Table 19: PMCP Selecting Number of Trajectory Groups and Model Fit with BIC

Number of Groups	BIC (n=267)	BIC (n=806)	Null Model	Bays' Factor Approximation	Evidence Against Null Model
1	-2319.85	-2320.96			
2	-2266.67	-2269.98	1	1.38e+22	Strong
3	-2262.47	-2268.00	2	7.24	Moderate
4	-2267.13	-2274.86	3	0.00	Weak
Three Group Model					
(2,1,0)	-2259.70	-2264.67			
(2,0,0)	-2258.79	-2263.21	(2,1,0)	4.31	Moderate

Note. 0 = Constant; 1 = Linear; 2 = Quadratic.

Individual students were assigned to each of the three groups by use of the maximum

posterior probability rule. Average assignment probabilities for each group are listed in Table 21

and descriptive statistics for each group are provided in Table 22. The total number of

adolescents classified into the *Low Curvilinear* group was 36 (13.5%) and the average posterior

probability for individuals classified into this group was .82. The *Low Curvilinear* group

consisted of mainly African American youth (56% versus 38% for White and 6% for

Hispanic/Other). Household composition for this group was mostly low-income (average

household income was $13,346.82) and single mothers (73%) during early childhood.

Table 20: PMCP Censored Multiple Regression of Self-Regulation Score by Age (in Months) for each Trajectory Group

Groups		B	SE	t	P
Low Curvilinear	Intercept	8.08	0.82	9.82	<.001
	Linear	-0.14	0.05	-2.54	0.01
	Quadratic	0.00	0.00	3.17	0.00
Medium Stable	Intercept	12.17	0.41	29.97	<.001

High Stable	Intercept	16.16	0.31	51.64	<.001
	Sigma	3.42	0.10	33.25	<.001
	Group membership				
Low Curvilinear	(%)	15.15	3.75	4.04	<.001
Medium Stable	(%)	43.49	5.95	7.31	<.001
High Stable	(%)	41.35	6.00	6.89	<.001

A total of 125 (46.8%) adolescents were placed into the *Medium Stable* group with an average assignment probability of .75 for youth placed in this group. African American and White youth were evenly distributed across the *Medium Stable* group (44% each). Youth in this group were more likely to have been low-income (average household income was $16,386.40) and raised by single mothers (62%) during early childhood.

Table 21: PMCP Average Assignment Probabilities based on Maximum Posterior Probability Rule

Assigned Group	Number Assigned	Group			Range
		Low Curvilinear	Medium Stable	High Stable	
Low Curvilinear	36	.82	.18	.00	.49-1.00
Medium Stable	125	.09	.75	.16	.51-.98
High Stable	106	.00	.15	.85	.52-1.00
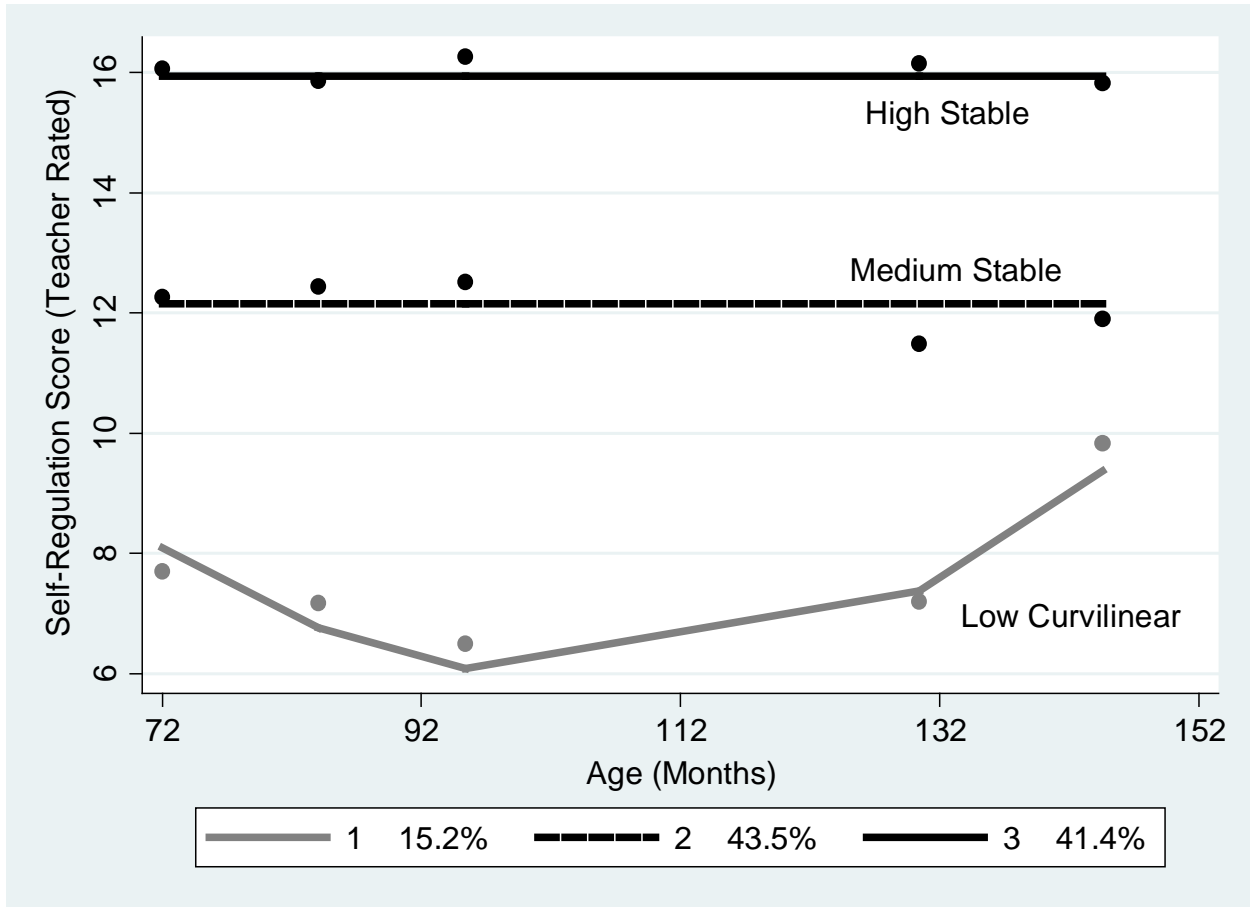
Figure 4: PMCP Self-Regulation Trajectories (n = 267)

The *High Stable* group received a total classification of 106 (39.7%) adolescents. The average posterior probability was .85 for all youth classified within this group. The *High Stable* group consisted mostly of White youth (67% versus 25% for African American and 8% for Hispanic/Other). *High Stable* adolescents were likely to have been raised by married parents (53%) in a low-income household (average household income was $20,325.00) during early childhood.

Table 22: PMCP Descriptive Statistics for Trajectory Groups

	Full Sample (n=267)	Low Curvilinear	Medium Stable (n=125)	High Stable (n=106)

	(n=36)				
	Mean/% (SD)	Min, Max	Mean/% (SD)	Mean/% (SD)	Mean/% (SD)
Early Childhood Covariates					
Child White	0.53		0.38	0.44	0.67
Child African American	0.38		0.56	0.44	0.25
Child Hispanic/Other	0.09		0.06	0.12	0.08
Maternal Education	12.76 (1.45)	8.00, 18.00	12.87 (1.77)	12.73 (1.50)	12.77 (1.28)
Household Income	17540.21 (9777.13)	4632.00, 54000.00	13346.82 (7760.70)	16386.40 (9076.43)	20325.00 (10456.36)
Mother Married	0.42		0.27	0.38	0.53
Outcome Covariates					
Scholastic Competence	12.37 (2.61)	5.00, 16.00	11.88 (2.60)	12.16 (2.68)	12.79 (2.49)
Proactive Aggression	1.51 (1.81)	0.00, 9.00	1.70 (1.79)	1.67 (1.97)	1.27 (1.59)
Peer Friendship Quality	12.49 (2.16)	3.00, 15.00	12.34 (2.16)	12.25 (2.16)	12.83 (2.15)
Adolescent Outcomes					
High School/GED/or less	0.18		0.30	0.18	0.14
Associate's or Bachelor's	0.68		0.62	0.70	0.66
Graduate Degree	0.14		0.08	0.12	0.20
Organizational Workplace Behaviors	9.45 (10.72)	0.00, 73.00	9.51 (12.40)	8.74 (10.64)	10.26 (10.24)
Interpersonal Workplace Behaviors	3.78 (5.77)	0.00, 43.00	4.55 (6.66)	3.63 (6.23)	3.70 (4.84)

	Reduced Sample (n=118)		Low Curvilinear (n=14)	Medium Stable (n=57)	High Stable (n=47)
	Mean/% (SD)	Min, Max	Mean/% (SD)	Mean/% (SD)	Mean/% (SD)
Adolescent Outcomes					
Romantic Relationship	20.68 (4.78)	5.00, 25.00	23.00 (3.37)	19.56 (5.18)	21.34 (4.32)

4.2.6 Demographic predictors of self-regulation group trajectory membership

Multinomial logistic regression analyses were conducted to determine whether maternal

education, household income, and child race/ethnicity would significantly predict self-regulation

trajectory group membership. Coefficients, standard errors, and relative risk ratios (RR) for significant pathways are presented in Table 23. Youth in the *High Stable* group were more likely to have higher household income and to be White (as opposed to African American) compared to the *Medium Stable* and *Low Curvilinear* groups. A one unit increase in household income resulted in a 9% reduced risk of classification in the *Low Curvilinear* group versus the *High Stable* group, and a 3% reduced risk (at trend level) of classification in the *Medium Stable* versus the *High Stable* group. Compared to White children, African American children were twice as likely to be classified in the *Low Curvilinear* and *Medium Stable* groups than the *High Stable* group, although the association between *Low Curvilinear* and *High Stable* only reached a trend. Maternal education and an Hispanic/Other heritage were not associated with any increased or decreased risk of classification in the *Low Curvilinear* and *Medium Stable* groups versus the *High Stable* group.

Findings contrasting the *Medium Stable* group with the *Low Curvilinear* group revealed no significant differences in demographic characteristics. Only household income approached a trend toward significance, such that a one unit increase in annual income was associated with a greater risk (1.06 times the risk) of classification into the *Medium Stable* versus the *Low Curvilinear* group. Maternal education and child race/ethnicity did not distinguish between these two groups.

Table 23: PMCP Multinomial Logistic Regression Demographic Characteristics Predicting Trajectory Group Membership

	Child and Family Predictors						
	Maternal Education		**Household Income**		**Child African American**		**Child Hispanic/Other**
	B (SE)	**RR**	**B (SE)**	**RR**	**B (SE)**	**RR**	**B (SE)**
High Stable							
Low Curvilinear	0.21 (0.15)		-0.09** (0.03)	0.91	0.75† (0.45)	2.12	-0.29 (0.87)
Medium	0.03		-0.03†	0.97	0.76*	2.14	0.70

n = 267.
$^{\dagger}p < .10;\ ^{*}p < .05;\ ^{**}p < .01.$

4.2.7 Self-regulation trajectory groups predicting academic engagement, romantic relationship quality, and workplace behaviors

Results examining the association between self-regulation group trajectory membership and academic engagement, romantic relationship quality, and workplace behaviors at age 20 are presented in Table 24. Findings indicate that youth in the *Low Curvilinear* group had more positive romantic relationships than their peers in the other two groups. Adolescent members of the *Low Curvilinear* group reported (at trend level) higher romantic relationship quality than youth in the *High Stable* group, and significantly higher relationship quality than youth in the *Medium Stable* group. Academic engagement and workplace behaviors were comparable across all three groups. In addition, the *High Stable* and *Medium Stable* groups did not differ across any of the outcomes: academic engagement, romantic relationship quality, and workplace behaviors.

Table 24: PMCP Trajectory Group Membership Predicting Engagement, Workplace Behaviors, and Romantic Relationship Quality

	Academic Engagement					
	HS/GED/or less		**Assoc. or Bach.**	**Organizational Workplace Behaviors**	**Interpersonal Workplace Behaviors**	**Romantic Relationship Quality**
	Assoc. or Bach.	**Graduate Degree**	**Graduate Degree**			
	B (SE)	**B (SE)**	**B (SE)**	**B (SE)**	**B (SE)**	**B (SE)**
High Stable						
Low Curvilinear	-0.66 (0.64)	-1.27 (0.96)	-0.61 (0.84)	-0.06 (2.20)	1.78 (1.22)	2.54† (1.50)
Medium Stable	-0.07 (0.50)	-0.43 (0.63)	-0.35 (0.42)	-0.95 (1.60)	0.53 (0.82)	-1.44 (0.96)

Low Curvilinear						
Medium Stable	0.58 (0.49)	0.84 (0.99)	0.25 (0.88)	-0.89 (2.12)	-1.26 (1.11)	-3.99** (1.44)

Note. Child race/ethnicity, maternal education, maternal marital status, and household income were included as covariates in all models. Scholastic competence, proactive aggression, and peer friendship quality were included as earlier outcome controls.

n = 267 for models with academic engagement and workplace behaviors.

n = 118 for models with romantic relationship quality.

[†]$p < .10$; [**]$p < .01$.

5.0   DISCUSSION

The current study examined longitudinal associations between structured assessments of early childhood self-regulation and self-reports of academic engagement and aspirations, romantic relationship quality, and workplace behaviors during middle and late adolescence. The potential for the teacher-child and parent-child relationship throughout middle childhood to mediate these associations was also explored, along with the possible role of the parent-child relationship in early childhood operating as a moderator of these associations. As additional follow-up of these research questions, group-based trajectory analyses were also used to examine heterogeneity in teacher-reported self-regulation trajectories throughout middle childhood. Demographic predictors were used to predict the likelihood of individuals with specific characteristics being classified into each group. Subsequently, trajectory group membership was used to predict adolescent academic engagement, romantic relationship quality, and workplace behaviors. Each research question was examined with two longitudinal U.S. datasets: one comprised mainly of White middle-income participants, and the second was a low-income, racially diverse sample.

The study builds on existing literature by exploring the long-term benefits of adaptive self-regulation during the preschool years, and exploring mechanisms that may explain how associations between early childhood and adolescent behaviors are established and maintained. An additional strength of this research is the use of person-centered analyses, to classify and track individuals into groups based on their unique growth patterns of self-regulation. The use of

such person-oriented research adds nuance to the existing literature by examining heterogeneity in behavioral trajectories, rather than employing the well-established approach of using level differences between two time points as the best method for measuring individual improvements or declines in self-regulation. Additionally, highlighting growth in self-regulation throughout early and middle childhood will enable researchers to identify "sensitive" periods during which they should intervene to target at-risk children. For example, is it enough for school-based interventions to target self-regulation skills in early childhood, or should these programs be revised so that they can be delivered to children throughout elementary, middle, and junior high? The current study, therefore, highlights various methods of measuring and establishing the protective benefits of adaptive self-regulatory skills in an effort to guide future home- and school-based intervention work.

5.1 ASSOCIATIONS BETWEEN SELF-REGULATION AND ADOLESCENT OUTCOMES: EARLY CHILDHOOD ASSESSMENT VERSUS TRAJECTORY GROUPS

In the first research question, it was hypothesized that early childhood self-regulation would predict adolescent functioning. However, contrary to the initial hypothesis, no longitudinal associations among structured assessments of self-regulation in early childhood and academic engagement, romantic relationship quality, and workplace behaviors in adolescence emerged. In fact, these null findings were consistent across both datasets. The results also conflict with past research which showed links between earlier assessments of self-regulation and numerous

indicators of functioning in both adolescence and adulthood (e.g., Caspi 2000; Moffitt et al., 2011).

Although these null results may initially appear discouraging, the lack of significant findings does not necessarily mean that early childhood self-regulation does not relate to adolescent outcomes. Given the large time span between both assessments, early childhood self-regulation could have influenced a number of mechanisms or processes (e.g., peer and adult relationships, academic performance, behavior problems, and self-regulation throughout middle childhood and adolescence), such that over time, the combined effects of these mechanisms simultaneously impacted functioning. The more concurrent these multiple contextual factors are with the outcomes of interest, the more robust we could expect these associations. Therefore, by the time adolescence is reached, early childhood self-regulation may no longer account for variability in functioning (i.e., the whole is greater than the sum of the parts), but still would have contributed to the overall journey. On a related note, the early childhood analyses also did not take into account growth or declines in self-regulation that may have occurred in between the early childhood and adolescent assessments. If behaviors are changing over time, then a single time point may not have provided enough information to detect a significant association between self-regulation and adolescent functioning. Lack of accounting for developmental change may also explain some of the contradictory findings with previous literature. For example, Moffitt et al. (2011) averaged self-regulation scores across ages 3, 5, 7, 9 and 11, and thus accounted for some of the variability in self-regulation across early and middle childhood.

Fortunately, the current dissertation was able to address the issue of developmental change in self-regulation across early and middle childhood through the use of group-based trajectory analyses. Although no evidence of longitudinal associations between early childhood

self-regulation and adolescent functioning surfaced, the hypotheses that heterogeneity in self-regulation trajectories would be detected and that trajectory group membership would predict adolescent outcomes were supported. In both samples, the majority of children (67%-87%) demonstrated stability in self-regulation over time; however, approximately 33% of the NICHD SECCYD and 13% of the PMCP experienced growth or declines throughout middle childhood. Fluctuations in self-regulation for these sizeable groups lend further support for our explanation as to why assessments in early childhood may not always predict later development. Using person-centered analyses to capture profiles of individual development provides a more accurate and complete picture of how competencies unfold and set some individuals on a track toward success and others on a track toward poorer functioning. Therefore, relying on an assessment measured at a single time point, although useful for establishing some short-term developmental associations, may not provide enough information to reliably predict outcomes in the long-term.

In order to establish the importance of examining developmental trajectories as the preferred method over analyzing a single time point, we examined bivariate correlations among the first teacher report of self-regulation in early childhood, the last teacher report of self-regulation in early adolescence, and the adolescent outcomes across both samples. Self-regulation at age 12 was significantly correlated with some measures of academic engagement across both samples and with negative romantic relationship quality for the SECCYD only. No significant correlations were found between the initial self-regulation score in early childhood and adolescent functioning. However, all coefficients were relatively small in magnitude, ranging in size from 0.0 to 0.3. The findings indicate that although the most recent report of self-regulation was more consistently related to the adolescent outcomes than the earliest, neither time point could account for the experiences in between that were captured through modeling

developmental trajectories. In other words, where individuals begin and where they end up are not as important as the overall journey.

Researchers have used person-centered analytic techniques to address similar concerns about intra-individual behavioral instability throughout childhood and the differential impact these divergent trajectories have on developmental outcomes.   For example, research on the development of antisocial behaviors has shown that many individuals start out low in early childhood, experience a sharp increase and peak in antisocial behaviors in adolescence, and then decline thereafter (Moffitt, 1993). Other researchers have also found groups of individuals that start out initially high in antisocial behaviors and then decrease rapidly throughout adolescence (Monahan, Steinberg, Cauffman, & Mulvey, 2009; Shaw, Hyde, & Brennan, 2012). Therefore, for individuals whose behaviors fluctuate throughout childhood and adolescence, an early behavioral assessment collected at a single time point might not accurately predict later functioning.

Recent work has also demonstrated the importance of looking at change in self-regulation, as opposed to level differences, in relation to adolescent functioning. For example, King, Fleming, Monahan, and Catalano (2011), found that the rate of change in impulse control from Grade 6 through Grade 8 was a stronger predictor of substance abuse in high school than initial levels of impulse control in middle childhood. Additionally, for a small community sample of youth, changes in effortful control throughout pre-adolescence were associated with levels of externalizing and internalizing behaviors and social competence above and beyond the contribution of their initial levels of effortful control (King, Lengua, & Monahan, 2013).

The relevance of tracking intra-individual changes in skill formation among young children has also been demonstrated. For example, Wanless and colleagues used group-based

trajectory analyses to track the development of behavioral regulation over three time points in a sample of preschoolers from Taiwan, and detected two distinct groups of children: *early regulators* and *late regulators* (Wanless et al., 2013a). Both early and late regulators had comparable behavioral regulation scores at the initial assessment as well as at the final assessment. However, *early regulators* experienced steady improvement in behavioral regulation from age 3.5 to 6 years of age, whereas *late regulators* improved little from age 3.5 years to age 5 years, and then increased rapidly thereafter. Using these groups to predict academic performance in kindergarten, Wanless et al. (2013a) found that *early regulators* had higher vocabulary scores than their late regulating peers, lending further support for the argument that single assessments of child behaviors may not provide enough information about how competencies unfold over time and relate to later functioning.

5.2   TEACHER-CHILD AND PARENT-CHILD RELATIONSHIPS AS MEDIATORS AND MODERATORS

We hypothesized that parent-child and teacher-child relationships in middle childhood would partially mediate the association between self-regulation and adolescent functioning. However, since no associations were found between the early childhood self-regulation assessments and adolescent outcomes in either datasets, mediation of these pathways could not be tested. Instead, the possibility of indirect pathways from self-regulation to academic engagement, romantic relationship quality, and workplace behaviors were explored, and again, no evidence for indirect pathways between early childhood self-regulation and adolescent outcomes via adult-child

relationship quality were detected. The lack of indirect pathways generally stemmed from insignificant direct pathways between self-regulation and adult-child closeness and conflict. The findings were also consistent across both the NICHD SECCYD and the PMCP samples. The only exception was a significant negative association between self-regulation and teacher-child conflict for the NICHD SECCYD.

We also hypothesized that the parent-child relationship in early childhood would moderate the association among early childhood self-regulation and academic engagement, romantic relationship quality, and workplace behaviors. However, little support was found for high quality parenting buffering the detrimental effects of poor self-regulation. Findings were also consistent across both samples.

Given the extant literature on the relevance of high quality parent-child and teacher-child interactions on child and youth development (Aunola & Nurmi, 2005; Barnes & Farrell, 1992; Birch & Ladd, 1997), why did these relationships fail to operate as mediators or moderators on adolescent functioning? There are four possible, but not mutually exclusive justifications that we suggest. First, it is highly probable that findings were not detected for the parenting analyses because the parent-child relationship is well-established in the first years of a child's life and greatly influences a child's ability to self-regulate (Calkins & Hill, 2007; Calkins & Leerkes, 2011; Sroufe, 1996). Therefore, parent-child relationship quality may be better conceived as a developmental precursor to early childhood self-regulation, an association that was not tested in the present study.

A second explanation for the nonsigificant findings could be that the benefits of adaptive self-regulation and the detriments of poor self-regulation are consistent regardless of individual differences in environmental adversity. For example, one study found that early childhood self-

regulation operated consistently for children with varying risk factors (low socioeconomic status and English Language Learners), indicating that the benefits of positive self-regulation and the deficits of poor self-regulation may be universal for different subtypes of children (McClelland & Wanless, 2012). The main difference, however, between the current dissertation's findings and the McClelland and Wanless (2012) study is that self-regulation did not predict outcomes in the present study. However, if the parent-child relationship is a developmental precursor of early childhood self-regulation, as provided in the previous explanation, then this would still clarify the lack of the parent-child relationship operating as a buffer.

A third probable reason for the null mediator and moderator findings could be that parent- and teacher-child relationships are more likely to be shaped by characteristics of the parents and teachers themselves. For example, psychological factors that have been known to influence parenting and teaching behaviors, such as maternal depression and teacher burnout and stress (Jennings & Greenberg, 2009; Lovejoy, Graczyk, O'Hare, & Neuman, 2000), may have better explained the variability in adult-child relationships in middle childhood. Children influence the behaviors of adults (Dennis, 2006), but if prior relationship patterns and interpersonal/psychological factors are more robust predictors, this could explain the overwhelming lack of findings for the association between early childhood self-regulation and adult-child relationships in middle childhood.

Finally, as proposed in section 5.1, intra-individual instability in self-regulation may explain why parent- and teacher-child relationship quality did not mediate or moderate these associations. Particularly, the early childhood assessment for the 13- 33% of students who experienced growth or declines in self-regulation, may not have accurately reflected their skill levels during middle childhood when these relationship ratings were collected. If relationships

with parents and teachers developed in conjunction with improvements or declines in self-regulation for these youth, then these developmental trajectories should be taken into account. Therefore, in order to tease apart these effects, follow-up analyses should focus on (1) testing the mediational and moderational research questions separately for youth with self-regulation stability versus youth with instability, and (2) examining trajectories of adult-child relationships in relation to self-regulation trajectories.

5.3   TRAJECTORY GROUP ANALYSES

5.3.1   Descriptions of self-regulation trajectory groups

As mentioned previously, evidence for heterogeneity in teacher-reported self-regulation trajectories throughout middle childhood was supported across both samples. Particularly for the NICHD SECCYD, four groups emerged: *High Stable* (67%)*, Medium Increasing* (15%)*, Medium Decreasing* (11%)*,* and *Low Curvilinear* (6%)*.* For the PMCP, a total of three groups emerged: *High Stable* (40%)*, Medium Stable* (47%)*,* and *Low Curvilinear* (14%)*.* These developmental patterns were consistent with past research in which Hay and Forrest (2006) found that approximately 16% of their sample demonstrated temporal instability in parent-reports of self-regulation throughout middle childhood and adolescence.   Furthermore, the emergence of both *High Stable* and *Low Curvilinear* groups across both samples, and rated by multiple teachers over time, implies that these findings are not spurious, but may reflect true variability in self-regulation growth for subsamples of individuals.   Proportions of group membership for *High Stable* and *Low Curvilinear*, however, varied across the NICHD SECCYD

and the PMCP, which may have been related to differences in the demographic composition of both samples. The PMCP, a sample characterized by low-income boys, for instance, had a lower percentage of students classified into the *High Stable* group (27% difference) and a higher percentage of students classified into the *Low Curvilinear* group (8% difference), compared to the NICHD SECCYD.

5.3.2 Demographic characteristics predicting self-regulation trajectory group membership

Consistent with our hypotheses, evidence emerged that demographic characteristics predicted group membership across both samples. For the NICHD SECCYD, males were more likely to be classified into the less positive developmental trajectories (*Medium Increasing*, *Medium Decreasing*, and *Low Curvilinear*) relative to the most positive trajectory group: *High Stable*. Likewise for both the NICHD SECCYD and PMCP, African American children were far less likely than White children to be classified into the *High Stable* group than the other less positive self-regulation trajectory groups. For both samples, higher income children were more likely to be grouped into more positive developmental trajectories, particularly in contrast to the *Low Curvilinear* group. In the NICHD SECCYD, children from households with more highly educated mothers were also more likely to be classified into the *High Stable* group relative to the other three groups. Maternal education did not distinguish groups for the PMCP, possibly due to the lower variability in maternal education across these three groups. Additionally, no findings were detected in either sample for Hispanic children, which could be attributed to the relatively low proportion of children in both datasets that identified as Hispanic (or Hispanic/Other for the PMCP). Overall, however, findings for demographic predictors were consistent with past

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research in which teachers tend to rate girls and White children as higher in self-regulation and adjustment, compared to African Americans and boys (Eisenberg et al., 2005a; Eisenberg et al., 2005b; Pigott & Cowen, 2000). Children from higher-income and higher maternal education households have also received higher ratings of self-regulation than their lower SES peers (Bernier, Carlson, & Whipple, 2010; Evans & Rosenbaum, 2008; Sbarra & Pianta, 2001).

What does the composition of these groups tell us about child functioning? First, these group differences demonstrate that SES factors are important determinants of child behaviors. Children reared in low-income households or living in poverty are often exposed to a number of psychological and physical stressors such as neighborhood violence, harsh and inconsistent parenting, caregiver distress, and less cognitively stimulating activities at home (Brooks-Gunn, Duncan, & Aber, 1997; Conger et al., 2002; McLoyd, 1998). Risk factors associated with socioeconomic disadvantage can negatively affect the organization and development of children's regulatory abilities (Raver, 2004). The increased likelihood of boys and African American children classified into lower self-regulation groups may also reflect significant sociocultural differences in socialization. For instance some studies have shown that boys are socialized by parents to be more assertive and competitive than girls (Clearfield & Nelson, 2006; Fagot & Hagan, 1991). For African American children, it is important to keep in mind that socioeconomic status is often confounded with race, in that African American children are disproportionately more likely than White children to grow up in poverty (Raver, 2004). Therefore, racial differences in trajectory group membership seem more likely to arise from factors associated with socioeconomic disadvantage.

Secondly, given the demographic variability that emerged across trajectory groups, what additional factors could be examined in relation to self-regulation? Factors such as

neighborhood crime or poverty, maternal depression, peer deviancy, and parent-child relationship quality could also differentiate between groups and allow for the examination of cumulative risk in relation to self-regulation trajectories. Future work should employ cluster or profile analyses to place individuals into groups based on similar indicators of risk and examine how these clusters relate to self-regulation. As with all person-centered research in which the whole is always greater than the sum of the parts, examining combinations of multiple risk versus protective factors for clusters of children would provide more holistic and detailed profiles of the youth categorized in each self-regulation trajectory group.

5.3.3   Self-regulation trajectory groups as predictors of adolescent outcomes

Some support emerged for the final hypothesis that trajectory group membership would predict adolescent functioning. Across both samples, only differences in romantic relationship quality were consistently uncovered. Few findings were detected for academic engagement, but only in the NICHD SECCYD, whereas none of the models detected group membership differences in workplace behaviors. Unexpectedly, the *Medium Decreasing* group appeared to have the worst outcomes, relative to the other three groups in the NICHD SECCYD. The *Medium Decreasing* group received consistently higher scores in self-regulation than the *Low Curvilinear* group, but the *Low Curvilinear* group demonstrated little difference in outcomes relative to the *High Stable* and *Medium Increasing* groups. For the PMCP, individuals classified into the *Low Curvilinear* group also had similar outcomes as individuals belonging to the *High Stable* and *Medium Stable* groups, and actually reported greater romantic relationship quality relative to these two groups. These findings are even more surprising given that individuals in the *Low Curvilinear* groups of both datasets (which comprise the smallest proportion of both samples), also have the highest

demographic risk factors relative to the other groups (i.e., lowest maternal education, lowest average household income, and greatest proportion of single mothers). Yet, they appear to be a rather resilient group, having comparable outcomes with the more positive trajectory groups: *High Stable*, *Medium Increasing*, and *Medium Stable*. The *Medium Decreasing* group, however, does have a higher number of risk factors compared to the *High Stable* and the *Medium Increasing* groups, but appears to be less resilient than its *Low Curvilinear* peers.

Although the poorer outcomes detected for the *Medium Decreasing* group, relative to the *Low Curvilinear* group, were unexpected the positive romantic relationship findings for the *Low Curvilinear* groups across both samples are consistent with the evolutionary theory of socialization proposed by Belsky, Steinberg, and Draper (1991). The theory posits that when youth are raised in highly stressful environments, they are more likely to sexually mature earlier than their peers due to evolutionary/biological processes that favor reproductive success. Research has since confirmed that exposure to stressful home environments is associated with early pubertal maturation in both boys and girls (Chisholm, Quinlivan, Petersen, & Coall, 2005; Ellis & Garber, 2000; Ellis, Shirtcliff, Boyce, Deardorff, & Essex, 2011). In the present dissertation, both *Low Curvilinear* groups consisted of higher SES risk factors relative to the other groups. If greater stress and adversity in the home and more dysfunctional relationships with parents and family members resulted in earlier sexual maturation for both males and females in the *Low Curvilinear* groups, then we could expect these adolescents to compensate for this adversity by investing more time in romantic or sexual relationships with their peers. Regarding the *Low Curvilinear* group for the PMCP, their higher reports of romantic relationship quality, relative to the *High Stable* and *Medium Stable* groups, may especially reflect their desire to invest in a satisfying interpersonal relationship that emerged outside of their familial home.

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To further examine this implication, additional risk factors in the household and timing of pubertal maturation would need to be examined across trajectory groups for both samples.

Past work also revealed complexities associated with analyzing relations among behavioral trajectory groups, risk factors, and developmental functioning. A study by Shaw et al. (2012) that used group-based trajectory modeling to track antisocial behavioral trajectories during adolescence found a group of *High Decreasing* boys (started out high in antisocial behaviors at age 10 and declined by age 17). The boys reported that they were making substantial improvements in behaviors over time, despite experiencing a large number of risk factors in early childhood and adolescence and also having a high number of arrests at age 17. Shaw et al. (2012) found that this group reported that they were highly skillful at telling lies, and therefore the authors concluded that the adolescents may have underreported their problem behaviors. Given that the present study relied on teacher reports of children's self-regulation, which can be biased based on children's demographic characteristics, such as race/ethnicity (Bradshaw, Mitchell, O'Brennan, & Leaf, 2010), it is possible that teachers may have underestimated the self-regulation ability of children in the *Low Curvilinear* groups. Possibly the use of observer rated self-regulation would have provided a different picture of self-regulation growth for these children. It is also possible that additional risk factors that were not explored in this study could explain the poorer outcomes detected for the *Medium Decreasing* group. Shaw et al. (2012), for example, looked at parenting practices, neighborhood poverty, maternal depression, peer deviancy, and youth personality characteristics as risk factors during sensitive transition periods in early childhood and early adolescence. Some of these risk factors could have differentiated the *Medium Decreasing* group from the *Low Curvilinear* group.

Another potential explanation for these differences could be that self-regulation is a developmental asset that operates as a buffer for children facing multiple risk factors (McClelland & Wanless, 2012; Shiner & Masten, 2012). The children classified into *High Stable*, *Medium Stable*, *Medium Increasing*, and *Low Curvilinear* groups are all marked by either temporal consistency or improvement in self-regulation throughout middle childhood. Moreover, despite differences in SES composition across all of these groups, they demonstrated similar adolescent outcomes within their respective samples. The *Medium Decreasing* group, on the other hand, is the only group characterized by steady and continuous declines in self-regulation and poorer adolescent outcomes relative to the other groups. For the *Low Curvilinear* groups with the highest SES risk factors, the ability to improve in self-regulation may point to their resiliency from having the benefit of this developmental asset.

What do these findings mean for intervention efforts designed to target and promote self-regulation? If outcomes between *High Stable*, *Medium Stable*, *Medium Increasing*, and *Low Curvilinear* groups were all comparable, can it be assumed that endorsing consistently high self-regulation is unnecessary? Is stability at medium levels good enough to promote positive functioning among youth? Despite the comparable findings among trajectory groups for this particular study, we cannot make these recommendations. The outcomes assessed in this dissertation are not all-encompassing; there are a host of relevant indicators of adolescent functioning that were unexplored, such as criminal behaviors/delinquency, psychological well-being, teen pregnancy, risky sexual behaviors, and substance abuse. Further research is needed, therefore, to elucidate if additional outcomes are foreshadowed by these trajectories.

5.4   CONCLUSIONS

Past research has indicated that self-regulation plays a rather supportive role throughout childhood and adolescence, contributing to a number of relevant social outcomes (Caspi, 2000; Moffitt et al., 2011). Contrary to this work, however, the present study found limited support for early and middle childhood self-regulation as predictors of adolescent functioning. Given these contradictory findings, what conclusions can be drawn about the developmental importance of self-regulation? Should research efforts be focused on promoting these skills, or do individual differences in self-regulation lead to similar levels of functioning in adolescence? Without minimizing the relevance of these skills for future research, there are three main points that can be emphasized from this dissertation.

The first conclusion, drawn from the heterogeneity of self-regulation trajectories from both the NICHD SECCYD and the PMCP, is that self-regulation skills are a multifaceted set of skills that develop over time in complex ways. More work should be done to unravel how the instability patterns detected for both samples relate to various domains of adolescent functioning, particularly in contrast to individuals with stable-high development. It is possible that differences in self-regulation trajectories are more robust predictors of developmental dysfunction (e.g., substance abuse, risky sexual behavior, psychological functioning), than positive functioning in adolescence. In other words, early self-regulation may still matter for functioning in adolescence or adulthood, even if the present study did not find much support for links to later positive outcomes.

A second conclusion drawn from this study is the extent to which self-regulation is embedded within developmental contexts. Demographic characteristics predicted self-regulation trajectories such that children from more disadvantaged backgrounds (e.g., low-income and

lower maternal education) were more likely to be classified within less positive developmental trajectories, and children from more advantaged backgrounds were more likely to be assigned to more adaptive trajectory groups. Self-regulation, therefore, is a highly contextualized set of skills, and begins its pathway of development early in a child's life (Raver, 2004). Children at high-risk for poor developmental trajectories would need to be intervened with early to prevent further declines (Raver, 2002).

A third and final conclusion that can be drawn from these studies is the complexity involved with identifying mechanisms that drive associations between early behaviors and later functioning. The mechanisms through which behaviors are maintained over the span of several years, are difficult to pinpoint at any given time (Moffitt et al., 2011). Further complicating this matter, is the fact that self-regulation is embedded in a number of contexts (e.g., home, school, peers) which consistently shape its levels and trajectories over time. Further studies will need to be conducted to tease apart how these factors may simultaneously influence early childhood self-regulation and adolescent functioning.

5.5   LIMITATIONS

Although the current study had many methodological strengths, including the use of a longitudinal design, multiple data sources, and sophisticated person-centered analytic techniques, it is important to note that there are limitations to the interpretation of the analyses. First, the design of the study was correlational. Causal inference, therefore cannot be determined from the present analyses. Additionally, there are limitations to the generalizability of the findings. The NICHD SECCYD and PMCP datasets are not nationally representative, and therefore results

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can only be generalized to comparable samples of children. However, despite the differences in demographic composition between the two samples, the similar findings across all research questions bolsters support for the applicability of the results to diverse populations of U.S. urban children and youth. There are additional caveats to generalizing these findings within the samples themselves. The majority of individuals within both samples were not involved with a partner at the time of the romantic relationship quality assessment, which is not unusual given the age of the participants (age 15 for NICHD SECCYD and age 20 for PMCP). In order to avoid the pitfalls of estimating missing values for nonexistent data for such large proportions of the samples, the decision was made to only include individuals in the romantic relationship analyses who provided information on this assessment. The same procedure was used regarding trajectory group membership, in which a reduced sample (individuals with at least one teacher report of self-regulation) was used in those analyses as well. Unfortunately, using subsets of the full sample for specific analyses can create generalizability problems when comparing within-sample analyses.

Differences in characteristics between groups of youth with or without romantic partners and trajectory data were conducted (see Results section for descriptions). Findings suggested that for the NICHD SECCYD, individuals with a romantic partner at age 15 appeared to be a higher risk group than those without a romantic partner (few differences were detected for the PMCP). Although differences for these groups were not necessarily substantial in magnitude, it must be taken into consideration that the romantic relationship subsample did differ from the unromantically attached majority on a number of factors, possibly limiting comparability and indicating that early romantic involvement may foreshadow poorer outcomes in the future, regardless of the quality of the relationship (Belsky et al., 1991).

A third limitation that may account for some of the null findings across both samples involves statistical power and data coding issues. In the NICHD SECCYD dataset, for example, the behavioral codes were collapsed into two categories signifying that the child either passed or failed the assessment. A larger coding metric may have more sensitively captured behavioral variability in the assessment. For the PMCP, limited data on academic engagement were available. Therefore, a broad range of academic engagement behaviors (e.g., behavioral vs. emotional) could not be examined in relation to self-regulation. Furthermore, across both samples, relatively small numbers of adolescents were involved in a romantic relationship; thus, low statistical power for the romantic relationship quality findings could also have explained some of the null findings.

The use of observer report for the early childhood self-regulation assessment for the first set of research questions and the use of teacher report for the group-based trajectory analyses may also explain the divergent findings for the present study. Correlations between parent and teacher reports of children's behavior problems and behavioral regulation tend to be low to moderate (Achenbach, McConaughy, & Howell, 1987; Wall & Paradise, 1981; Winsler & Wallace, 2002), and studies have also found substantial differences between teacher and observer ratings of behavioral regulation among diverse U.S. and Taiwan samples (Loo & Rapport, 1998; Wanless, McClelland, Acock, Chen, & Chen, 2011). Teacher ratings and independent observers, therefore, may provide different information on children's behaviors. Teachers spend significant amounts of time with children, establish relationships with them, and are witnesses to a range of behaviors within various classroom contexts and situations. The nature of their relationship with the child, however, may introduce bias and interfere with the teacher's ability to be objective when rating behaviors. Other salient child characteristics such as race/ethnicity may also bias

teacher ratings (Bradshaw, Mitchell, O'Brennan, & Leaf, 2010). Trained observers, on the other hand, have no prior relationship with the child or preconceived notions about their behavior, and therefore, may provide a more objective measurement of their behaviors. The drawback, however, is that observers are not often able to capture a broad range of behaviors over various time points, contexts, and situations in a naturalistic setting. Both methods offer useful information in assessing child behaviors and it is not clear if different findings would emerge if the group-based trajectory analyses would have relied on direct observations from trained researchers. Future studies may want to examine differences in trajectories of self-regulation development using multiple sources to determine which methods are the most reliable at predicting which outcomes.

A final noteworthy caveat is that group-based trajectory analyses to track individual growth rates should not be used as a tool for diagnosing children (Nagin, 2005). As the analytic technique is based on maximum posterior probability estimations of group assignment, there is always room for error, and individuals may be incorrectly classified into groups. The purpose of the tool, therefore, should be to describe heterogeneity in self-regulation development, explore some common demographic characteristics or predictors of group membership, and estimate differential pathways of functioning for each group. These analyses could then be used to inform preventative school- and home-based interventions that can administer training and support to children, teachers, and parents to reduce the number of children at higher risk for following a path toward developmental dysfunction. Far more extensive research would be needed to determine appropriate time periods to place supports and which services would be most effective.

5.6   IMPLICATIONS FOR RESEARCH AND PRACTICE

The results of this study have provided a number of recommendations for future research and practice endeavors. First, the limited number of findings should not dissuade researchers from pursuing further connections between early childhood self-regulation and adolescent or adult outcomes. Given that both samples used in this study were not specifically designed to link positive self-regulation to positive functioning in adolescence (NICHD SECCYD was designed to study early child care environments and the PMCP was designed to study the development of aggression/delinquent behaviors), there were limits to the measures of both self-regulation and positive youth outcomes used in these analyses. Scholars interested in undertaking their own research in this topic area should take advantage of multiple methods of assessing self-regulation and adolescent behaviors both via the source (e.g., structured assessments, parent report, teacher report, youth report, peer report) and the instruments or measures. Using multiple measures to capture specific constructs within each domain will also provide more nuanced associations among specific self-regulation skills (e.g., delay of gratification, attention, classroom behavioral regulation) to specific adolescent behaviors (e.g., satisfaction with romantic partner, negative or positive affect during interactions, problem-solving or conflict resolution techniques, abusive behaviors).

Secondly, given that there were a number of individuals in both samples that demonstrated linear and curvilinear patterns of growth and decline in self-regulation, it may be worthwhile examining within-group heterogeneity in outcomes. If significant within-group variability in developmental outcomes is detected, then developmental precursors, risks, or assets may be identified to distinguish individuals with better functioning from those who are struggling. If outcomes are similar for all youth within the same trajectory group, then further

support would be provided for the universal effects of self-regulation on adolescent development.

Finally, although the current dissertation was not focused on evaluating or administering behavioral interventions, the findings do offer some insight into future program design. Early intervention work posits that targeting skills early will promote socio-emotional behaviors later in adolescence or adulthood (Belfield et al., 2006). However, some researchers have contended that early intervention programs do not always succeed, likening these programs to a vaccination or magic elixir metaphor whose effects should continue to protect the individual for the rest of his/her life without further intervention (Brooks-Gunn, 2003). Given that declines in self-regulation were discovered across both samples in the current dissertation, it is possible to conclude that these youth could benefit from program services throughout childhood and adolescence. It is not clear from the present data that interventions spanning early childhood through adolescence would be more successful at altering detrimental pathways than the implementation of a single early childhood program. However, the natural developmental fluctuations in self-regulation that emerged for many youth after the transition to kindergarten, lend some consideration to the idea that programs may provide more benefits to high-risk youth if they are made readily available and maintained as preventative supports throughout middle childhood and adolescence.

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