The Contribution of Adolescent Effortful Control to Early Adult Educational Attainment

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Abstract

Effortful control has been proposed as a set of neurocognitive competencies that is relevant to self-regulation and educational attainment (Posner & Rothbart, 2007). This study tested the hypothesis that a multiagent report of adolescents' effortful control (age 17) would be predictive of academic persistence and educational attainment (age 23–25), after controlling for other established predictors (family factors, problem behavior, grade point average, and substance use). Participants were 997 students recruited in 6th grade from 3 urban public middle schools (53% males; 42.4% European American; 29.2% African American). Consistent with the hypothesis, the unique association of effortful control with future educational attainment was comparable in strength to that of parental education and students' past grade point average, suggesting that effortful control contributes to this outcome above and beyond well-established predictors. Path coefficients were equivalent across gender and ethnicity (European Americans and African Americans). Effortful control appears to be a core feature of the self-regulatory competencies associated with achievement of educational success in early adulthood. These findings suggest that the promotion of self-regulation in general and effortful control in particular may be an important focus not only for resilience to stress and avoidance of problem behavior, but also for growth in academic competence.

Keywords: educational attainment level, self-regulation, academic achievement, adolescence, family background

The Contribution of Adolescent Effortful Control to Early Adult Educational Attainment

Education success and attainment is the clearest index of competence and success in modern western societies. At the individual level, higher educational attainment predicts quality of life throughout adulthood, including employment status, income, psychological and physical health, well-being, and community involvement (Adams, 2002; Day & Newburger, 2002; Herzog, Franks, Markus, & Holmberg, 1998; Karvonen et al., 2007; McCaul, Donaldson, Coladarci, & Davis, 1992; Ross & Mirowsky, 2006; Tobiasz-Adamczyk, Bartoszewska, Brzyski, & Kopacz, 2007; Zhang, Huang, Ye, & Zeng, 2008). From a societal perspective, it is necessary to promote higher rates of secondary school completion, postsecondary technical training, and college and graduate training to meet current socioeconomic and demographic challenges. These challenges include an aging workforce, which requires training of replacement workers; the fast pace of technological progress; and market globalization (Organisation for Economic Co-Operation and Development, 2005). During recent decades, researchers have identified many correlates of students' educational attainment, but high rates of school dropout and low attendance of postsecondary education programs still represent significant costs to industrialized countries, including the United States (Belfield, Levin, & Brookings, 2007) and Canada (Kirby, 2009). Thus, key targets must be identified for future intervention efforts aiming to help students persevere through their formal schooling. The main objective of this study was to examine the role of effortful control, an understudied yet promising predictor of school persistence, and to determine whether this predictor remains important after other known predictors of educational attainment are accounted for.

Predictors of Educational Attainment

Many aspects of students' family background and individual characteristics have been studied in the search for significant predictors of educational attainment. Family socioeconomic status (SES) and family processes are two major predictive family characteristics that have been examined in relationship to children's educational progression.

Family SES is a multifaceted concept that affects children's long-term educational outcomes in at least two ways. First, parental education plays an important role in children's educational progression. Parents with higher levels of education are more likely to encourage their children to pursue higher education and to have the resources to support this endeavor. As such, parents' level of educational attainment is a strong and consistent predictor of students' academic persistence as measured in early and middle adulthood (Dubow, Boxer, & Huesmann, 2009; Hardy et al., 1997; King, Meehan, Trim, & Chassin, 2006; Kristensen, Gravseth, & Bjerkedal, 2009; Marjoribanks, 2005; Taylor, Hurd, Seltzer, Greenberg, & Floyd, 2010), even after controlling for other significant indicators of family SES, including the value or ownership of their housing, family income, and the prestige of parents' occupation (Albrecht & Albrecht, 2011; Dubow et al., 2009; Kristensen et al., 2009; Melby, Conger, Fang, Wickrama, & Conger, 2008; South, Baumer, & Lutz, 2003; Taylor et al., 2010). A second implication of family SES is the degree to which it relates to family stress, instability, and neighborhood integration. Low-SES families tend to have a host of risk factors associated with elevated levels of family stress and poorer community integration (Albrecht & Albrecht, 2011; Melby et al., 2008; Ou, 2005; South et al., 2003; Taylor et al., 2010); risk factors may include frequent residential transitions, having young parents, or living in a single or unmarried household, all of which are related to lower educational attainment.

Family process factors also play a valuable role in children's educational attainment. Parents who have overly negative interactions with their children or who have personal problems that undermine effective parenting (e.g., couple issues) can impede their child's persistence in school (Dubow et al., 2009; King et al., 2006). Conversely, children whose parents are involved in their education, have a supportive parenting style, or hold high expectations for their educational attainment tend to stay in school longer (Ou, 2005; Pettit, Yu, Dodge, & Bates, 2009; Taylor et al., 2010). Robertson and Reynolds (2010) looked at the global influence of favorable family context by assigning students to clusters based on measures of demographic variables (e.g., mother age and education, number of adults living in the home, parental employment, subsidized meals) and of parenting (e.g., child maltreatment, parental involvement, parental expectations). Four clusters were found to be internally consistent in terms of human capital resources (based on demographic data) and family functioning. As predicted, children belonging to clusters that had higher levels of resources and high-quality parenting reached higher levels of educational attainment.

Numerous student characteristics have also been evaluated as predictors of future educational attainment, and they can be classified as risk or compensatory factors. Risk factors include predictors of poor academic adjustment, which can precipitate dropout or discourage involvement in higher education. Youth externalizing problems, especially when documented in childhood or early adolescence, have often been identified as predictors of lower educational attainment (King et al., 2006; McLeod & Kaiser, 2004; Pettit et al., 2009). Substance use later in adolescence also has been consistently linked with poorer school persistence (Chatterji, 2006; Hardy et al., 1997; King et al., 2006; Ryan, 2010).

Compensatory factors that help facilitate progression through the education system have also been identified. They include students' educational aspiration and academic success (often

assessed using grade point average [GPA], standardized test scores, inclusion on the honor roll, avoidance of grade retention), which are strong and reliable predictors of educational attainment (Albrecht & Albrecht, 2011; Ganzach, 2000; Hardy et al., 1997; King et al., 2006; Marjoribanks, 2005; Mello, 2008; Ou, 2005; Pettit et al., 2009; South et al., 2003). Cognitive functioning, such as childhood IQ or general cognitive ability in early adulthood (Dubow et al., 2009; Kristensen et al., 2009), and positive psychological dispositions, including positive academic self-concept, academic engagement, future orientation, and positive temperamental dispositions (Beal & Crockett, 2010; Hampson, Goldberg, Vogt, & Dubanoski, 2007; Marsh & O'Mara, 2008; Melby et al., 2008), are also indicative of future educational attainment.

The extensive literature describing established risk and compensatory factors for educational attainment makes it possible to identify with considerable confidence students who are at high risk for leaving school before they obtain an adequate level of educational training. Because so many of these factors are difficult to alter, it is essential to identify student or parent characteristics that are amenable to change so that interventions can be developed to effectively bolster student retention, reduce dropout, and ultimately promote educational attainment (Rumberger, 1987). In an effort to help determine new predictors that have stronger implications for intervention research, this study aimed at testing effortful control as a predictor of educational attainment by age 23.

Effortful Control

Effortful control is an aspect of temperament that reflects self-regulatory skill. Effortful control involves the ability to inhibit impulses and prevent disruptive behaviors (inhibitory control), to focus and maintain attention despite distractions (attention control), and to initiate and complete tasks that have long-term value, even when they are unpleasant (activation control; Rothbart & Bates, 1998).

Effortful control is heritable and shows moderate stability over time, but its development is also shaped by experience (Eisenberg et al., 2005; Goldsmith, Buss, & Lemery, 1997). Experimental studies have shown that aspects of effortful control can be improved in children, adolescents, and adults by a range of interventions, including mindfulness training (Sahdra et al., 2011; Tang et al., 2007), self-control exercises (Muraven, 2010), parent training (Somech & Elizur, 2012; Stormshak, Fosco, & Dishion, 2010), and school-based interventions (Diamond, Barnett, Thomas, & Munro, 2007; Raver et al., 2011).

A growing literature reveals that effortful control predicts academic success in children and adolescents, even after controlling for prior academic performance or general cognitive ability (Allan & Lonigan, 2011; Blair & Razza, 2007; Checa, Rodriguez-Bailón, & Rueda, 2008; Checa & Rueda, 2011; Valiente, Lemery-Chalfant, & Swanson, 2010; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008; Zhou, Main, & Wang, 2010). Posner and Rothbart (2007) have proposed that understanding the neurocognitive features of effortful control, its malleability, and its role in the growth of competence in children is perhaps the most important agenda item for future research in education sciences. In fact, Posner and Rothbart propose that we should consider educating the human brain as much as teaching traditional content domains, such as reading, writing, and math. They contend that developing the neurocognitive skill of effortful control will benefit growth in general cognitive competence as much as in domain-specific skills. Although this idea is intriguing, relatively little research has examined it in general, let alone specific to adolescence and young adulthood. This omission is noteworthy in that adolescence is a turning point for many youths, at which time some disengage from academics and others persist into higher levels of educational attainment.

In our study we extended findings about effortful control and academic success in childhood and adolescence by examining the relationship between effortful control and

educational attainment in young adulthood. Effortful control may play a particularly important role in the pursuit and successful completion of postsecondary education. In comparison with earlier years of schooling, postsecondary education has unique qualities that make self-regulation especially important. Not only is postsecondary education voluntary, it also occurs within the developmental context of increasing freedom and responsibilities (Arnett, 2000). It requires that students manage the demands related to completion of their coursework and degree programs (time management, course selection, completion of long-term projects) in a context that provides less support and structure than is common in earlier levels of education. In addition, students are faced with the challenges of balancing the demands of their education with an expanding array of competing options and responsibilities that arise in emerging adulthood. Thus, it is expected that higher levels of effortful control will promote the planfulness that is involved in choosing to pursue higher education and the self-management that is required to successfully complete a degree. Consistent with this perspective, evidence is emerging that links school persistence and aspects of effortful control. For example, a recent study by Andersson and Bergman (2011) found that task persistence at age 13 was a statistically significant, albeit modest, predictor of educational attainment 30 years later. In addition, Wolfe and Johnson (1995) found that in predicting college GPA, self-discipline outperformed SAT standardized assessment scores. Although this preliminary research is promising, an important research goal is to determine whether effortful control predicts educational attainment.

This Study

The aim of this study was to evaluate the role of effortful control in the progression toward higher levels of educational attainment in early adulthood. Because of policy and intervention implications of this study, we controlled for many of the family and individual variables that have historically predicted educational attainment so that we could conduct a more

stringent test of the unique contribution of effortful control to educational attainment. Specifically, we controlled for key family processes, such as relationship quality and effective parenting practices, adolescent problem behavior during middle school, adolescent substance use and GPA during high school, and sociodemographic factors (family SES and parental education). We hypothesized that effortful control would be a significant predictor of educational attainment, above and beyond established predictors.

Effortful control was assessed using parent, teacher, and adolescent self-report methods to create a multi-informant latent construct to ensure strong measurement of this focal construct in our study. Furthermore, we used a 12-year longitudinal design to represent the hypothesized sequence of action of different predictors and to avoid the inflated correlations that occur when predictors and outcomes are measured simultaneously. A secondary goal of this study was to verify whether our prediction model could generalize to students of both genders and to students of various ethnic groups.

To achieve these goals, we used structural equation modeling (SEM) to test the model presented in Figure 1. The hypothesized sequence of action of various predictors reflects the sensitive periods identified in the studies cited earlier in this article in relation to family situation, early-adolescence problem behavior, substance use, and school adjustment as predictors of educational attainment. Positive family involvement and problem behavior are hypothesized to play an important role in early adolescence and to predict more proximal predictors of educational attainment, namely, substance use, high school cumulative GPA (CGPA), and effortful control in late adolescence. The possibility that early predictors are residually related to educational attainment about 10 years later is indicated by direct paths from early-adolescence predictors to the outcome measure. To keep Figure 1 simple, we did not depict residual correlations among predictors measured during the same developmental period, but they were

included in the statistical model (i.e., problem behavior was correlated with positive family involvement; substance use, high school CGPA, and effortful control were intercorrelated; and family SES and parental education were correlated with each other and with the five other predictors in the model). Our primary analyses were conducted on the entire sample, and we tested the generalizability of our findings to various subgroups by using multiple-group analyses.

Method

Participants

Participants were 997 adolescents and their families from the Project Alliance 1 study recruited in Grade 6 from three public middle schools in an ethnically diverse metropolitan community in the northwestern United States. Parents of all Grade 6 students in two cohorts (years 1996 and 1998) were approached for participation, and 90% consented. The participating sample included 526 males (52.8%) and 471 females (47.2%). By youth self-report, the sample comprised 423 European Americans (42.4%), 291 African Americans (29.2%), 68 Latinos (6.8%), 52 Asian Americans (5.2%), and 164 (16.4%) youths of other ethnicities, including mixed ethnicity. Parent reports collected when the adolescents were 16 years old revealed that 39.6% of participants lived with both genetic parents, 43.8% lived with their biological mother, 6.7% lived with their biological father, and 10.0% lived in other family configurations. The median range of gross annual household income was $30,000 to $39,999, with 25.3% of households earning less than $20,000 per year and 12.7% earning more than $90,000.

Because most participants remained in the same middle school from Grade 6 through Grade 8, and because data collection took place in the school setting, a high rate of retention was maintained across the first three time points. Most participants were streamed into a few local high schools whose principals agreed to help us track participants, which greatly facilitated data collection in Grades 9 and 11. These procedures, however, were not sufficient for participants

who stopped attending the schools involved in our study and were not useful after participants graduated from high school. Additional procedures were therefore put in place; namely, at each time point, participants were asked to fill out a form with their current contact information (mailing address, phone numbers) and to provide the contact information of other people (e.g., friends, family members) who could help us find them if they had moved before the next time point of our data collection. Participants were also paid $5 for sending us their new contact information when they moved. Under those circumstances, questionnaires that were usually filled out in school could be filled out at home and mailed back to us. Together, these longitudinal retention procedures were very effective, with approximately 80% of youths being retained across the study span.

One half of the study sample was randomly assigned to a multilevel family-centered ecological approach to family intervention and treatment (EcoFIT; Dishion & Kavanagh, 2003; Dishion & Stormshak, 2007), which aimed at preventing substance use and problem behavior in adolescents. Intent-to-treat analyses revealed positive intervention effects in relation to substance use (Connell, Dishion, & Deater-Deckard, 2006), antisocial behavior (Van Ryzin & Dishion, 2012), and the probability of police arrest (Connell, Klostermann, & Dishion, 2012). In addition, using complier average causal effect (CACE) analyses to assess the impact of families' engagement in the selected level of this intervention (the Family Check-Up), we found significant intervention effects on substance use, problem behavior, school grades, and attendance during middle and high school (Connell, Dishion, Yasui, & Kavanagh, 2007; Stormshak, Connell, & Dishion, 2009; Véronneau, Dishion, & Connell, under review). Because improving educational attainment was not a goal of this program and because traditional intent-to-treat effects were not found for academic outcomes in middle and high school, we did not expect major differences in the covariance matrices of the intervention and control groups based on the variables of interest

in this study. To verify this assumption, we used participants' raw data while testing for equivalence of the unconstrained covariance matrices for the treatment and control groups and found good model fit for most, but not all indices: $\chi^2(76) = 110.02$, $p < .01$, RMSEA = .03, CFI = .98, TLI = .97. The chi-square test suggests that we should reject the null hypothesis stating that the treatment and control groups have equivalent covariance matrices; in contrast, all other fit indices suggest that constraining the covariance matrices of the two groups yields a well-fitting model, with both CFI and TLI > .95 and RMSEA < .06 (Hu & Bentler, 1999). Because the chi-square test may be overly sensitive to trivial group differences when large sample sizes are used (as is the case in this study), we prioritized the other fit indices and concluded that the two groups did not differ with regard to the covariance of our study's variables. Therefore, data from the two groups were pooled in this study's analyses.

Assessment Procedures

School-based self-report assessments of problem behavior and family involvement were collected from students in Grades 6 through 8 using an adaptation of a survey instrument developed and reported by scientists at the Oregon Research Institute for the Community Action for Successful Youth (CASY) project (Metzler, Biglan, Ary, & Li, 1998). In Grade 11, a larger assessment protocol was conducted that included additional student self-report surveys, teacher ratings that were administered in the high school setting, and parent-report questionnaires that were completed at home and mailed to our research office. This Grade 11 assessment was the final school-based assessment. After high school, subsequent assessments were conducted when participants were approximately 19 years old and again when they were approximately 23 years old. The age 19 assessment was limited in scope and did not pertain to the current study. However, age 23 questionnaires captured constructs of interest to our study. At this wave, questionnaires were sent directly to participants' homes and were returned to our research office

by mail. All respondents were assured of the confidentiality of their responses. Participants, parents, and teachers were compensated for their participation.

Measures

Family socioeconomic status (SES). SES was measured by parent report of their employment status, income, housing status, and financial aid to the family. For employment status, we used the highest score based on reports from both primary caregivers when participants were from two-parent families (*full-time* or *self-employed* [coded 4]; *part-time* [3]; *seasonal* [2]; *disabled, unemployed, temporary layoff, homemaker, retired,* or *student* [1]). One global score was used for each of the other indicators: family housing (*own your home* [coded 5], *rent your home* [4], *motel/temporary* [3], *live with a friend* or *live with a relative* [2], and *emergency shelter* or *homeless* [1]); household income (*$90K or more* [coded 7], *between $70K and $90K* [6], *between $50K and $70K* [5], *between $30K and $50K* [4], *between $20K and $30K* [3], *between $10K and $20K* [2], and *less than $10K* [1]); and financial aid (sum of dichotomous indicators of whether the family received food stamps, Aid to Dependent Children, other welfare, medical assistance, and Social Security death benefits, reverse coded). These variables were standardized and averaged (α = .75). In this study, SES information was not collected from youths because of concern that it would potentially be unreliable information. The Grade 11 data collection was the first time point when all parents were surveyed, and thus this is the earliest wave of SES data for the overall sample. SES was not assigned to a specific developmental period in the model and was treated as a fixed variable that other predictors from any time point could be correlated with.

Parental education. At the Grade 11 assessment, caregivers reported on the highest level of education that they themselves had achieved: *graduate degree* or *college degree* (coded 5), *junior college* or *partial college* (4), *high school graduate* (3), *partial high school* or *junior high completed* (2), and *7th grade or less* or *no formal schooling* (1). When data were provided for

two primary caregivers, we used the highest of the two scores.

Positive family involvement. This latent variable was measured from a combination of three youth-report indicators. For each of these three indicators, an average score based on data collected in Grades 6, 7, and 8 was computed as a reliable index for the entire middle school period. The first indicator, positive family relations, was based on a six-item scale that included statements such as "I really enjoyed being with my parents," "My parents trusted my judgment," "Family members backed each other up." Each item was scored on a scale ranging from 1 (*never true*) to 5 (*always true*) within the past month, and a mean score was computed from the six items (αs for Grades 6 through 8 ranged from .89 to .90). The second indicator, parental monitoring, was based on a five-item scale that asked the youths how often their parents knew what they were doing away from home, where they were after school, what their plans were for the next day, and what were their interests, activities, and whereabouts. Each item was scored on a scale ranging from 1 (*never or almost never*) to 5 (*always to almost always*), and a mean score was created based on all five items (αs for Grades 6 through 8 ranged from .85 to .87). The third indicator, homework rule, included one item that reflected whether parents had a rule about the child doing homework every day. The item was scored on a scale ranging from 1 (*don't have a rule or expectation*) to 4 (*have a clear rule*).

Problem behavior. Problem behavior was measured using a nine-item self-report scale administered in Grades 6, 7, and 8. The variable was created from an average score based on data collected at all three time points to create a reliable measure for the entire middle school period. Sample items include "Stayed out all night without parents' permission," "Intentionally hit or threatened to hit someone at school," and "Stole or tried to steal things worth more than $5." Each item was rated on a scale from 1 (*never*) to 6 (*more than 20 times*), and the reference period

was during the past month (αs at Grades 6 through 8 ranged from .77 to .84).

Effortful control. The three indicators of the effortful control construct were administered in Grade 11: parent report, self-report, and teacher report. Parent and child reports were based on the Effortful Control scale from the short form of the Early Adolescent Temperament Questionnaire–Revised (EATQ-R; Ellis & Rothbart, 2005). The EATQ-R Effortful Control scale consists of 16 items that assess activation control (the capacity to perform an action when there is a strong tendency to avoid it; e.g., "If I have a hard assignment to do, I get started right away"), attention (the capacity to focus attention as well as shift attention when desired, e.g., "It is really easy for me to really concentrate on homework problems"), and inhibitory control (the capacity to plan and to suppress inappropriate responses, e.g., "I can stick with my plans and goals"). Each item was scored on a scale from 1 (*almost always untrue*) to 5 (*almost always true*), with higher scores indicating greater effortful control.

Previous work by Ellis and Rothbart (2001) reports evidence of the validity of the Effortful Control scale for a sample of adolescents ranging in age from 10 to 16. Their study demonstrated adequate internal consistency ($\alpha = .80$ for the self-report, $\alpha = .87$ for the parent report) and acceptable convergence ($r = .50$) between adolescent and parent report (Ellis, 2002). The self- and parent-report versions include essentially the same items, with the pronouns changed appropriately. For the parent reports, participants' mothers, fathers, and other guardians could all complete the Effortful Control scale. When multiple caregivers responded, those answers were averaged into one parent-report score. Internal consistency for the 16-item Effortful Control scale was .63 for youths, .77 for mothers, and .82 for fathers.

The third indicator, teacher report of effortful control, consisted of five items with content similar to that of the EATQ-R Effortful Control scale (e.g., "thinks ahead of time about the

consequences of actions," "plans ahead before acting," "pays attention to what he or she is doing," "works toward goals," and "sticks to what he or she is doing until it is finished, even with unpleasant tasks"). Teachers used a 5-point rating scale to describe how frequently each participant engaged in these behaviors. The internal consistency of the teacher-report scale was $\alpha = .94$.

Cumulative grade point average (CGPA). Students' academic records were gathered from the schools from Grade 9 through 11. If a participant moved to another school, we sought academic records from the new school as well. GPA was measured on a scale ranging from 0 to 4, with higher scores reflecting better grades (F = 0, D = 1, C = 2, B = 3, A = 4). GPA was obtained at the end of each school year as the average grade across participants' academic courses for that year. For youths who attended multiple schools during an academic year, an adjusted GPA was computed as the average of the available GPAs, weighted to reflect the proportion of the school year they represented. Our analyses used a CGPA measure computed as the average of all yearly GPA data available for Grades 9 through 11. For the cohort of participants who were originally enrolled in 1998 (about half of the participants), CGPA in Grade 11 was unavailable because of a change in the school district's record-keeping system. Other students had missing GPA data because of school dropout or because they attended schools that were unable to provide official academic records. As a result, 47% of participants had a CGPA measure based on all 3 years of high school; 30% had a CGPA measure based on Grades 9 and 10, and 12% had a CGPA based on Grade 9 only, resulting in 89% of participants with valid GPA data for the main analyses. Correlations between CGPA and yearly GPA were .80 for Grade 11, .93 for Grade 10, and .93 for Grade 9, all *p*s < .001.

Substance use. Participants completed a survey in Grade 11 that enabled us to measure the extent of their substance use. Participants reported on their use of tobacco, alcohol, marijuana, and other drugs, and an average score for substance use was created. Participants were asked to report their frequency of use during the past 3 months for each substance, on a scale ranging from 0 (*never*) to 7 (*2 or 3 times a day or more*). "Other drugs" was defined for the participants as any of the following substances: heroin, morphine, cocaine or crack, speed or meth, ecstasy, angel dust or PCP, acid or LSD, mushrooms, gasoline, glue, other inhalants, and prescription medications for recreational use.

Ethnicity. Although various ethnic groups were represented in this sample, only the two largest groups (European American and African American) could be used for ethnic comparison purposes, and we used youth report of their ethnicity.

Educational attainment. Participants reported on the highest level of education they had completed as of the age 23 assessment. This information was coded on a 4-point scale: *less than high school* (coded 1), *high school/GED* (2), *trade school/some college/specialized training/2-year college degree* (3), or *4-year college or graduate degree* (4). This measure was treated as an ordered categorical variable in the primary analyses.

Results

Preliminary Analyses

Missing data. For the variables included in our study, the mean percentage of missing data was 14% (range = 0% to 33%). Little's MCAR test was significant, $\chi^2(361) = 505.54$, $p < .001$, indicating that the data were not missing completely at random. We explored patterns of missingness based on the amount of missing data for different subgroups of participants by counting the number of variables for which there was a missing value for each participant. Then,

we examined correlations between the total number of missing values for each participant and their scores on other measured (i.e., nonmissing) variables.

Missing data were more common among male participants and among participants with lower educational attainment, lower CGPA, lower SES, lower parental education, lower parent-reported effortful control, less parental monitoring, and more substance use (rs = .08–18, ps < .05). Missingness differed significantly across ethnic groups, $F(2) = 4.66$, $p < .01$. When comparing European Americans, African Americans, and other minority groups combined, a post hoc Scheffé test revealed that participants from other minority groups had more missing data than did European American participants (mean difference = 1.21; $p < .05$).

Covariance coverage was moderate to high, ranging from .59 to 1.00. Full information maximum likelihood (FIML) was used within Mplus 7.0 to estimate parameters on the basis of all available information from each participant. Consequently, participants with occasional missing data were retained in the analyses. FIML has been shown to be very efficient when analyzing data from samples with moderate levels of missing values, and it is adequate even when data are not missing completely at random, as long as the predictors of missingness are included in the model (Widaman, 2006).

Descriptive statistics and correlations. Means, standard deviations, and correlations among all measured variables are presented in Table 1, along with the number of participants who provided valid data on each measure, and skewness and kurtosis values. Early problem behavior had a skew value greater than 2.0 and a kurtosis value greater than 8.0 (cutoffs provided by Kline, 2005) and was thus square root transformed. The transformed variable did not have significant skew or kurtosis and was used in all subsequent analyses. All other variables were approximately normally distributed (skew < 2.0 and kurtosis < 8.0). As expected, educational attainment had a strong positive correlation with CGPA; a moderate positive correlation with

family SES, parental education, and effortful control according to the teacher; and a weaker but significant positive correlation with positive family relations, parental monitoring, homework rule, and both self-report and parent report of effortful control. Educational attainment had a weak but significant negative correlation with early-adolescence problem behavior and late-adolescence substance use. CGPA, measures of positive family involvement, parental education, and SES were negatively correlated with measures of problem behavior and substance use.

Group differences. Gender and ethnicity differences in all observed variables were examined with a series of one-way ANOVAs. Females had higher educational attainment, higher CGPAs, higher ratings on caregiver and teacher reports (but not self-reports) of effortful control, less early-adolescence problem behavior, and more early-adolescence parental monitoring than did males (all Fs > 10.0, ps ≤ .001).

Ethnic differences were obtained for all measures except caregiver-reported effortful control. African American participants had higher self-reported effortful control but lower teacher-reported effortful control relative to Caucasian participants. CGPA, parental education, SES, and parental monitoring were lower for African American participants, and homework rule and positive family involvement were higher for African American participants. African American participants reported more problem behavior in early adolescence but less substance use in late adolescence, relative to Caucasian participants (all Fs > 4.45, ps < .05).

Primary Analyses

Hypothesis testing proceeded in two steps: evaluation of the hypothesized model (see Figure 1) and examination of group differences (gender and ethnicity) in model fit. We evaluated the fit of the hypothesized model to the data using Mplus 7.0. SEMs were run using the mean- and variance-adjusted weighted least square (WLSMV) estimator because the outcome variable (educational attainment) was ordered categorical. Therefore, parameter estimates for the

predictors of educational attainment can be interpreted as probit regression coefficients. Residual errors were allowed to correlate for latent-variable indicators with shared measures (i.e., child- and parent-reported effortful control, both of which used the EATQ-R questionnaire) and/or shared reporters (i.e., child-reported indicators of effortful control and family involvement). The model was deemed to have adequate fit if the comparative fit index (CFI) was > .95 and the root mean square error of approximation (RMSEA) was < .06 (Hu & Bentler, 1999). Good model fit is usually indicated by nonsignificant chi-square values, but because of the large size of our sample, this index of fit may be overly conservative (Schermelleh-Engel, Moosbrugger, & Müller, 2003). In this situation, it is common practice to give priority to the other fit indices in model fit evaluation.

To examine group differences we ran a series of multiple-group analyses (for gender and ethnicity) and compared model fit for unconstrained models (all regression and correlation coefficients free to vary across groups) and constrained models (coefficients constrained to be equal across groups). Because of the large sample size, we used change (Δ) in CFI to test for the significance of differences in fit. Fit was considered to be significantly different if the change in CFI was .01 or greater (Cheung & Rensvold, 2002).

The hypothesized model provided a good fit to the data, $\chi^2(29) = 116.18$, $p < .001$, CFI = .96, RMSEA = .06. Standardized coefficients for regression paths and factor loadings are presented in Figure 2. There were three significant predictors of educational attainment: adolescent effortful control (β = .33, *SE* = .09), parental education (β = .29, *SE* = .04), and high school CGPA (β = .26, *SE* = .08). All three predictors had effect sizes in, or very close to, the moderate range. We built a 95% confidence interval around these coefficients to test the null hypothesis that these predictors were of equal strength, and we were unable to reject it. This

suggests that adolescents with higher levels of effortful control at age 17 had higher levels of educational attainment by age 23, and the unique relation of effortful control with future educational attainment is comparable in strength to that of other well-established predictors. Other control variables used in this model were not statistically significant predictors of educational attainment, including family SES, problem behavior, and family involvement in early adolescence. Similarly, late-adolescence substance use was not associated with educational attainment. These nonsignificant paths are omitted from Figure 2 for parsimony, but they were still present in the statistical model. Correlations that were modeled between residual errors because of shared measures or reporters were positive and significant (*r*s = .10–.28, *p*s < .01). The estimated correlation matrix for the latent variables in the model is presented in Table 2. Model-estimated residual correlations among variables that were measured within the same developmental period were identical to those reported in Table 2, except for the following: family SES correlated significantly with substance use ($r = .08$, $p < .05$), CGPA ($r = .35$, $p < .001$), and effortful control ($r = .15$, $p < .01$); parental education correlated significantly with substance use ($r = .10$, $p < .01$), CGPA ($r = .35$, $p < .001$), and effortful control ($r = .11$, $p < .05$); substance use correlated significantly with CGPA ($r = –.10$, $p < .05$) and effortful control ($r = –.22$, $p < .001$); and CGPA correlated significantly with effortful control ($r = .67$, $p < .001$).

Tests of indirect effects were performed using confidence intervals based on the bias-corrected bootstrap method (MacKinnon, Lockwood, & Williams, 2004) to verify whether the late-adolescence predictors—effortful control and academic achievement—could explain the relation between early-adolescence predictors (family involvement and problem behavior) and educational attainment. Results revealed that effortful control was a significant mediator for none of the early-adolescence predictors. CGPA was a marginally significant mediator of the relationship between early-adolescence family involvement and educational attainment, with a

90% confidence interval for the β value ranging from .003 to .076 (point estimate = .032). Furthermore, CGPA was a significant mediator of the relation between early-adolescence problem behavior and educational attainment, with a 99% confidence interval for the β value ranging from –.131 to –.005 (point estimate = −.068).

Group invariance tests were conducted to determine whether differences in model fit were evident across groups, which would suggest moderation effects based on gender or ethnicity. Tests for group differences in model fit revealed no significant differences between constrained and unconstrained models for gender (Δ CFI = .002). The pattern of results obtained from a pooled within-group covariance matrix was identical to the one presented in Figure 2. In line with preliminary analyses, multiple-group analyses comparing ethnic groups (Caucasian versus African American) revealed that constraints imposed on mean levels of several variables had to be released. These included family SES, teacher rating of self-regulation, and parental monitoring. The constraint on the residual (unexplained) variance for educational attainment was also relaxed. This new model did not differ significantly from the unconstrained model.

Discussion

The main objective of this study was to test whether adolescents' effortful control is a significant predictor of their educational attainment in early adulthood, above and beyond established academic, familial, behavioral, and demographic factors. The significant relationship between effortful control and educational attainment supported our hypothesis, and follow-up analyses revealed that the final model applied to both genders and was generalizable across European American and African American participants.

Effortful Control as a Predictor of Educational Attainment

Effortful control is defined as a temperament-based individual characteristic that reflects self-regulatory skill, manifested by the ability to inhibit impulses and disruptive behaviors

(inhibitory control), to focus and maintain attention in spite of distractions (attention control), and to initiate and complete tasks that have long-term value (activation control; Rothbart, Ellis, & Posner, 2011). In this study, we tested whether effortful control was related to educational attainment after accounting for other well-documented predictors. After controlling for other factors, effortful control was directly associated with educational attainment. Moreover, our findings indicate that effortful control is as important as parental education and high school academic achievement for predicting educational attainment in early adulthood.

Several mechanisms could explain the relationship between effortful control and educational attainment and should be investigated in future studies. One possibility is that as students progress through the late high school years and postsecondary education, they must increasingly rely on their own volitional resources as parents and teachers step out of their supervisory responsibilities to encourage students' autonomous academic development. Adequate levels of effortful control may support the planfulness and self-management needed to successfully complete a postsecondary degree. In addition to increased demands on students' autonomy and planning skills, the changing nature and context of the schoolwork required of them can also represent a significant change in their academic life. Being able to adapt their work habits accordingly (e.g., creating study groups; starting to work on assignments many weeks before the deadline) and to maintain these new behaviors over the long term instead of persisting with or going back to old habits that may not be adaptive in this new context could be one way in which effortful control influences academic success and persistence.

Our findings are consistent with those presented in past studies that have explored other constructs related to effortful control as predictors of educational and professional success in adulthood (Andersson & Bergman, 2011; Wolfe & Johnson, 1995). This study builds on existing literature that underscores the importance of parental education and youth academic success as

key predictors of educational attainment. Beyond parental support and academic ability, adolescents' self-regulatory capacity inherent in effortful control makes a compelling argument for the importance of targeting effortful control in efforts to promote school persistence.

Our study findings also are consistent with those from past studies that have identified processes that can promote effortful control functioning (e.g., Fosco, Frank, Stormshak, & Dishion, 2013; Muraven, 2010; Stormshak et al., 2010). Although our study was not designed to test for predictors of effortful control, we did identify direct links between positive family involvement and problem behavior during early adolescence and later effortful control; however, we were unable to find significant indirect effects involving adolescent effortful control as a mediator of positive family involvement in the prediction of educational attainment. Nevertheless, the role of parenting in promoting effortful control is supported by other research, including a study by Bowers et al. (2011) showing that aspects of self-regulation closely related to effortful control tend to decrease during adolescence but can increase under conditions of good parental practices, as do GPA and school attendance.

Early-Adolescence Predictors

Previous work that had investigated the contribution of early-adolescence predictors of educational attainment prompted us to expect a negative relationship between problem behavior and future levels of educational attainment, and a positive relationship between positive family involvement—including the quality of relationships, parental monitoring, and rules about doing homework—and educational attainment. However, in our model, the direct paths between these factors from early adolescence and educational attainment were not significant. Instead, our findings suggest that these relationships are mediated by more proximal factors, such as academic achievement, which was a moderately strong predictor of educational attainment. The indirect effects of problem behavior and of family involvement on educational attainment support the idea

that these early predictors do matter and deserve attention from researchers and practitioners who seek to promote educational attainment in youths beginning at an early age.

Regarding the family-related predictors, it had already been established that warm but structuring parenting can facilitate academic achievement and discourage adolescents' substance use (Coombs & Landsverk, 1988; Leung, Lau, & Lam, 1998; Steinberg, Lamborn, Dornbusch, & Darling, 1992). Of particular interest to us, though, was the possibility that family involvement could help promote greater effortful control during adolescence, as suggested by recent studies (Bowers et al., 2011; Doan, Fuller-Rowell, & Evans, 2012). Without any earlier measurement of effortful control in the sample, it was not possible to verify whether this relationship simply reflected the enduring consequences of parent–child dynamics promoting effortful control early in childhood. Nevertheless, Stormshak et al. (2010) found that a parent-focused intervention was related to an improvement in their children's effortful control over time, which supports the view that parents can actively help their child develop higher levels of effortful control in middle school. Effortful control was, in turn, predictive of an increase in academic engagement in high school. This is a new and promising avenue for applied research in the domain of academic persistence. In fact, the role of family relationships may be particularly consequential, considering a study by Belsky and Beaver (2011) that suggested that genetic predispositions can make male adolescents particularly vulnerable to deficits in self-regulation when they are exposed to poor parenting practices.

The association between problem behavior in childhood and academic outcomes in adolescence has already been documented (Véronneau, Vitaro, Pedersen, & Tremblay, 2008), but the path from problem behavior to effortful control is of greater interest in this study. The absence of repeated measures of problem behavior and effortful control makes it difficult to settle with confidence on a specific direction of a possible causal effect. Numerous studies have linked

lower levels of effortful control (or related self-regulatory skill) in early childhood to later development of problem behaviors (e.g., Eiden, Edwards, & Leonard, 2007; King, Lengua, & Monahan, 2013; Lengua, 2006; Robins, John, Caspi, Moffitt, & Stouthamer-Loeber, 1996). However, our study also supports the possibility that young adolescents who engage in antisocial activities may, as a result, be diverted from opportunities to practice and reinforce their ability to exert effortful control—for example, by being suspended from school.

Late-Adolescence Predictors

Previous research that had suggested that substance use in later adolescence and academic achievement in high school could help predict which students would reach higher levels of educational attainment motivated us to include these two predictors as concurrent control variables when testing for effortful control as a predictor of educational outcomes.

Although the nonsignificant role of substance use in this study contrasts with results from other studies that revealed a significant role with a similar outcome, several explanations for the discrepant results are possible. For example, Hardy et al. (1997) found that smoking cigarettes in adolescence is related to lower levels of education in adulthood, but their educational outcome distinguished only between students who obtained a high school diploma/graduate equivalency degree (GED) and those who did not. Furthermore, their study assessed inner-city children who had been born in the 1960s, in contrast with our participants who were from a wider range of demographic backgrounds and who had been born in the 1980s. Cohort effects or differences in demographic backgrounds could explain the divergence of results between their study and ours. Ryan (2010) found a detrimental contribution of marijuana use, but again the sample of participants had been born much earlier (the late 1950s to early 1960s), and the control variables used in this study focused more heavily on sociodemographic characteristics than on family dynamics and students' academic achievement. A study by King et al. (2006) that used a more

comparable set of control variables found, by using growth modeling techniques, a significant contribution of drug use (but not alcohol use) to the likelihood of attending college. This finding suggests that research focused on the specific contribution of substance use to educational attainment would benefit from sophisticated longitudinal modeling of such variables. Because effortful control has already been shown to reduce the risk of increases in tobacco and marijuana use over time (Piehler, Véronneau, & Dishion, 2012), it is interesting to note that the association between effortful control and educational attainment in our study was completely independent from substance use. In other words, it is unlikely that the link between effortful control and higher educational attainment can be explained merely by the capacity to refrain from using substances.

Consistent with past research, our study revealed that academic competence in high school as measured from school records of academic achievement (CGPA) was a significant predictor of educational attainment, and its influence was moderate in size, just like that of effortful control and of parental education. It should be noted that CGPA was highly correlated with effortful control (r = .71 for the estimated bivariate correlation, and r = .67 for the model estimated residual correlation). The strong correlation between academic achievement and effortful control is consistent with results from theoretical work and empirical work linking effortful control to academic performance (e.g., Allan & Lonigan, 2011; Checa et al., 2008; Posner & Rothbart, 2007; Valiente et al., 2010). Longitudinal studies with repeated measurements of both effortful control and academic achievement would help confirm the sequence of action of effortful control and academic achievement that predict educational attainment.

Sociodemographic Factors

In line with past research, students' sociodemographic background played an important role in the prediction of educational attainment. We expected that families with higher income and more stable living conditions (e.g., owning or renting a house rather than living in a precarious housing situation) are in a better position to support their child through their high school studies and provide financial resources that facilitate access to higher education. Although a moderate correlation emerged between family SES and participants' educational attainment in preliminary bivariate analyses, this association was not significant in the overall model, when controlling for other predictors. In contrast, parent education was linked to children's educational attainment in the overall model, independent of family financial resources. This finding provided support for our decision to examine the influence of parent education and that of other SES indicators separately. Our study cannot speak to the mechanisms linking parent education to child educational attainment in this sample, but numerous plausible explanations have been identified by other studies, including parental involvement, parents' ability to understand and navigate the school system, parental expectations, and family attitudes toward schooling (e.g., Martin, 2012; Pettit et al., 2009). Given that effortful control is partly heritable, the link between parents' and children's educational attainment might also reflect genetic predispositions for self-regulatory skills that support school success and persistence.

Strengths and Limitations

This study possesses many strengths. First, our main predictor, effortful control, was based on a latent variable that included parent, teacher, and self-reports. Also, we were able to control for most of the established predictors of educational attainment, which strengthens our conclusions about the significant role of effortful control in predicting our outcome of interest. In addition, the longitudinal design made it possible to use predictors at important times of development from early to late adolescence and to assess educational attainment in early

adulthood, when a good level of variance has emerged in this variable. The large number of participants helped us identify small effects and compare results across subgroups of participants (gender, ethnicity). It is noteworthy that the relationships between the many predictors in this model and educational outcomes were consistent across genders and ethnic groups (European American vs. African American). This suggests that concrete interventions based on the results from this study are likely to be relevant for most students. Further research that includes a larger number of students belonging to the smaller ethnic groups is needed, however, to verify if our results generalize to them.

Some limitations in this study would be useful to consider in future work. Having access to earlier measurements of effortful control would have been very helpful to test its contribution to educational attainment from a process standpoint. For example, effortful control at an early age could affect educational attainment through its influence on academic achievement, family relationships, or other mediators. Repeated measures of effortful control could even help determine whether it can be increased through environmental influences or intervention programs. To help explore those possibilities, a more recent study by our research group (Project Alliance 2; Stormshak et al., 2010) included several measures of effortful control completed during the adolescent years. Another limitation is that this study had no measure that allowed us to control for students' educational aspiration, which has been shown in past research to be a significant predictor of educational attainment (e.g., Dubow et al., 2009; Marjoribanks, 2005; South et al., 2003). In addition, the longitudinal nature of the study led to some missing-data issues. In general, missing data was more common among males and among lower functioning adolescents (lower CGPA, lower effortful control, more substance use) and parents (lower SES, lower parental education, less parental monitoring). These patterns might limit the generalizability of our results and suggest that lower functioning participants might have had

more difficulty responding to the questionnaires, possibly because of lower reading abilities or because of additional stressful life events that may leave them less time or less availability to answer a questionnaire. Still, by using FIML to manage missing values, we are confident that our results are less biased than those we would have obtained using other popular strategies (e.g., listwise deletion, mean substitution, single imputation; Widaman, 2006).

Conclusion

This study showed that effortful control in late adolescence is a significant predictor of educational attainment by age 23, and its associated effect size was comparable to those of high school CGPA and parental education. This finding indicates the importance of self-regulatory skills for success in postsecondary education and suggests that efforts to improve educational attainment may be enhanced by programs that promote the development of self-regulatory skills. To date, research examining the malleability of effortful control through socialization and through exposure to cognitively and emotionally challenging tasks has shown encouraging results in children and adolescents. Dropout prevention programs could include an effortful control reinforcement component that begins early on and continues throughout the high school years as a way to further support the pursuit and completion of higher education. Substantive and lasting improvement in the level of educational attainment in the population is likely to require a combination of strategies that targets not only individual students, but also their environment, including family members, schools, community institutions, and governing bodies at the local and national levels. Programs that support the development of self-regulation may prove to be an important part of these efforts.

References

Adams, S. J. (2002). Educational attainment and health: Evidence from a sample of older adults. *Education Economics, 10*(1), 97–109.

Albrecht, C. M., & Albrecht, D. E. (2011). Social status, adolescent behavior, and educational attainment. *Sociological Spectrum, 31*(1), 114–137.

Allan, N. P., & Lonigan, C. J. (2011). Examining the dimensionality of effortful control in preschool children and its relation to academic and socioemotional indicators. *Developmental Psychology, 47*(4), 905–915. doi: 10.1037/a0023748

Andersson, H., & Bergman, L. R. (2011). The role of task persistence in young adolescence for successful educational and occupational attainment in middle adulthood. *Developmental Psychology, 47*(4), 950–960. doi: 10.1037/a0023786

Arnett, J. J. (2000). Emerging adulthood: A theory of development from the late teens through the twenties. *American Psychologist, 55*(5), 469–480. doi: 10.1037/0003-066x.55.5.469

Beal, S. J., & Crockett, L. J. (2010). Adolescents' occupational and educational aspirations and expectations: Links to high school activities and adult educational attainment. *Developmental Psychology, 46*(1), 258–265.

Belfield, C. R., Levin, H. M., & Brookings, I. (2007). *The price we pay: Economic and social consequences of inadequate education*. Washington, DC: Brookings.

Belsky, J., & Beaver, K. M. (2011). Cumulative–genetic plasticity, parenting and adolescent self-regulation. *Journal of Child Psychology and Psychiatry, 52*(5), 619–626. doi: 10.1111/j.1469-7610.2010.02327.x

Blair, C., & Razza, R. P. (2007). Relating effortful control, exécutive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development,*

78(2), 647–663.

Bowers, E. P., Gestsdottir, S., Geldhof, G. J., Nikitin, J., von Eye, A., & Lerner, R. M. (2011). Developmental trajectories of intentional self-regulation in adolescence: The role of parenting and implications for positive and problematic outcomes among diverse youth. *Journal of Adolescence, 34*(6), 1193–1206. doi: 10.1016/j.adolescence.2011.07.006

Chatterji, P. (2006). Illicit drug use and educational attainment. *Health Economics, 15*(5), 489–511. doi:10.1002/hec.1085

Checa, P., Rodríguez-Bailón, R., & Rueda, M. R. (2008). Neurocognitive and temperamental systems of self-regulation and early adolescents' social and academic outcomes. *Mind, Brain, and Education, 2*(4), 177–187. doi: 10.1111/j.1751-228X.2008.00052.x

Checa, P., & Rueda, M. (2011). Behavioral and brain measures of executive attention and school competence in late childhood. *Developmental Neuropsychology, 36*(8), 1018–1032.

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), 233–255.

Connell, A. M., Dishion, T. J., & Deater-Deckard, K. (2006). Variable- and person-centered approaches to the analysis of early adolescent substance use: Linking peer, family, and intervention effects with developmental trajectories. *Merrill-Palmer Quarterly, 52*(3), 421-448.

Connell, A. M., Dishion, T. J., Yasui, M., & Kavanagh, K. (2007). An adaptive approach to family intervention: Linking engagement in family-centered intervention to reductions in adolescent problem behavior. *Journal of Consulting and Clinical Psychology, 75*(4), 568-579.

Connell, A. M., Klostermann, S., & Dishion, T. J. (2012). Family Check-Up effects on

adolescent arrest trajectories: Variation by developmental subtype. *Journal of Research on Adolescence,22,* 367–380. doi: 10.1111/j.1532-7795.2011.00765.x

Coombs, R. H., & Landsverk, J. (1988). Parenting styles and substance use during childhood and adolescence. *Journal of Marriage & the Family, 50*(2), 473–482. doi: 10.2307/352012

Day, J. C., & Newburger, E. C. (2002). The big payoff: Educational attainment and synthetic estimates of work–life earnings. *Current Population Reports*. Washington, DC: U.S. Census Bureau.

Diamond, A., Barnett, W. S., Thomas, J., & Munro, S. (2007). Preschool program improves cognitive control. *Science, 318*(5855), 1387–1388. doi: 10.1126/science.1151148

Dishion, T. J., & Kavanagh, K. (2003). *Intervening in adolescent problem behavior: A family-centered approach.* New York, NY: Guilford Press.

Dishion, T. J., & Stormshak, E. A. (2007). *Intervening in children's lives: An ecological, family-centered approach to mental health care.* Washington, DC: American Psychological Association.

Doan, S. N., Fuller-Rowell, T. E., & Evans, G. W. (2012). Cumulative risk and adolescent's internalizing and externalizing problems: The mediating roles of maternal responsiveness and self-regulation. *Developmental Psychology, 48*(6), 1529-1539. doi: 10.1037/a0027815

Dubow, E. F., Boxer, P., & Huesmann, L. R. (2009). Long-term effects of parents' education on children's educational and occupational success: Mediation by family interactions, child aggression, and teenage aspirations. *Merrill-Palmer Quarterly: Journal of Developmental Psychology, 55*(3), 224–249.

Eiden, R. D., Edwards, E. P., & Leonard, K. E. (2007). A conceptual model for the development of externalizing behavior problems among kindergarten children of alcoholic families: Role of parenting and children's self-regulation. *Developmental Psychology, 43*(5), 1187-1201. doi: 10.1037/0012-1649.43.5.1187

Eisenberg, N., Zhou, Q., Spinrad, T. L., Valiente, C., Fabes, R. A., & Liew, J. (2005). Relations among positive parenting, children's effortful control, and externalizing problems: A three-wave longitudinal study. *Child Development, 76*(5), 1055–1071. doi: 10.1111/j.1467-8624.2005.00897.x

Ellis, L. K. (2002). *Individual differences and adolescent psychosocial development*. Unpublished doctoral dissertation, University of Oregon.

Ellis, L. K., & Rothbart, M. K. (2001). *Revision of the Early Adolescent Temperament Questionnaire*. Poster presented at the 2001 Biennial Meeting of the Society for Research in Child Development, Minneapolis, MN.

Ellis, L. K., & Rothbart, M. K. (2005). *Revision of the Early Adolescent Temperament Questionnaire (EAT-Q).* Manuscript in preparation.

Fosco, G. M., Frank, J. L., Stormshak, E. A., & Dishion, T. J. (2013). Opening the “black box”: Family Check-Up intervention effects on self-regulation that prevents growth in problem behavior and substance use. *Journal of School Psychology.* Advance online publication. doi: http://dx.doi.org/10.1016/j.jsp.2013.02.001

Ganzach, Y. (2000). Parents' education, cognitive ability, educational expectations and educational attainment: Interactive effects. *British Journal of Educational Psychology, 70*(3), 419–441.

Goldsmith, H. H., Buss, K. A., & Lemery, K. S. (1997). Toddler and childhood temperament: Expanded content, stronger genetic evidence, new evidence for the importance of environment. *Developmental Psychology, 33*(6), 891–905. doi: 10.1037/0012-1649.33.6.891

Hampson, S. E., Goldberg, L. R., Vogt, T. M., & Dubanoski, J. P. (2007). Mechanisms by which childhood personality traits influence adult health status: Educational attainment and healthy behaviors. *Health Psychology, 26*(1), 121–125.

Hardy, J. B., Shapiro, S., Mellits, E. D., Skinner, E. A., Astone, N. M., Ensminger, M., . . . Starfield, B. H. (1997). Self-sufficiency at ages 27 to 33 years: Factors present between birth and 18 years that predict educational attainment among children born to inner-city families. *Pediatrics, 99*(1), 80–87. doi: 10.1542/peds.99.1.80

Herzog, A. R., Franks, M. M., Markus, H. R., & Holmberg, D. (1998). Activities and well-being in older age: Effects of self-concept and educational attainment. *Psychology and Aging, 13*(2), 179–185.

Hu, L.-T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1–55. doi: 10.1080/10705519909540118

Karvonen, J. T., Joukamaa, M., Herva, A., Jokelainen, J., Läksy, K., & Veijola, J. (2007). Somatization symptoms in young adult Finnish population: Associations with sex, education level and mental health. *Nordic Journal of Psychiatry, 61*(3), 219–224.

King, K. M., Lengua, L. J., & Monahan, K. C. (2013). Individual differences in the development of self-regulation during pre-adolescence: Connections to context and adjustment. *Journal of Abnormal Child Psychology, 41*(1), 57–69. doi: 10.1007/s10802-012-9665-0

King, K. M., Meehan, B. T., Trim, R. S., & Chassin, L. (2006). Marker or mediator? The effects of adolescent substance use on young adult educational attainment. *Addiction, 101*(12), 1730–1740.

Kirby, D. (2009). Widening access: Making the transition from mass to universal post-secondary education in Canada. *Journal of Applied Research on Learning, 2*, 1–17. doi: citeulike-article-id:9860079

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd. ed.) New York, NY: Guilford Press.

Kristensen, P., Gravseth, H. M., & Bjerkedal, T. (2009). Educational attainment of Norwegian men: Influence of parental and early individual characteristics. *Journal of Biosocial Science, 41*(6), 799–814.

Lengua, L. J. (2006). Growth in temperament and parenting as predictors of adjustment during children's transition to adolescence. *Developmental Psychology, 42*(5), 819–832. doi: 10.1037/0012-1649.42.5.819

Leung, K., Lau, S., & Lam, W.-L. (1998). Parenting styles and academic achievement: A cross-cultural study. *Merrill-Palmer Quarterly, 44*(2), 157–172.

MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research, 39*, 99–128. doi: 10.1207/s15327906mbr3901_4

Marjoribanks, K. (2005). Family background, academic achievement, and educational aspirations as predictors of Australian young adults' educational attainment. *Psychological Reports, 96*(3), 751–754.

Marsh, H. W., & O'Mara, A. (2008). Reciprocal effects between academic self-concept, self-esteem, achievement, and attainment over seven adolescent years: Unidimensional and multidimensional perspectives of self-concept. *Personality and Social Psychology Bulletin, 34*(4), 542–552. doi: 10.1177/0146167207312313

Martin, M. A. (2012). Family structure and the intergenerational transmission of educational advantage. *Social Science Research, 41*(1), 33–47. doi: 10.1016/j.ssresearch.2011.07.005

McCaul, E. J., Donaldson, G. A., Jr., Coladarci, T., & Davis, W. E. (1992). Consequences of dropping out of school: Findings from high school and beyond. *Journal of Educational Research, 85*(4), 198–207.

McLeod, J. D., & Kaiser, K. (2004). Childhood emotional and behavioral problems and educational attainment. *American Sociological Review, 69*(5), 636–658. doi: 10.1177/000312240406900502

Melby, J. N., Conger, R. D., Fang, S.-A., Wickrama, K. A. S., & Conger, K. J. (2008). Adolescent family experiences and educational attainment during early adulthood. *Developmental Psychology, 44*(6), 1519–1536.

Mello, Z. R. (2008). Gender variation in developmental trajectories of educational and occupational expectations and attainment from adolescence to adulthood. *Developmental Psychology, 44*(4), 1069–1080.

Metzler, C. W., Biglan, A., Ary, D. V., & Li, F. (1998). The stability and validity of early adolescents' reports of parenting constructs. *Journal of Family Psychology, 12*(4), 600–619. doi: 10.1037/0893-3200.12.4.600

Muraven, M. (2010). Building self-control strength: Practicing self-control leads to improved self-control performance. *Journal of Experimental Social Psychology, 46*(2), 465–468. doi: 10.1016/j.jesp.2009.12.011

OECD (2005). *Rationale for creating a global forum on education*. In Education Global Forum 2005 (Home). Retrieved May 26, 2006, from http://www.oecd.org/document/56/0,2340,en_21571361_35013845_35123640_1_1_1_1,00.html

Ou, S.-R. (2005). Pathways of long-term effects of an early intervention program on educational attainment: Findings from the Chicago longitudinal study. *Journal of Applied Developmental Psychology, 26*(5), 578–611.

Pettit, G. S., Yu, T., Dodge, K. A., & Bates, J. E. (2009). A developmental process analysis of cross-generational continuity in educational attainment. *Merrill-Palmer Quarterly, 55*(3), 250–284.

Piehler, T., Véronneau, M.-H., & Dishion, T. (2012). Substance use progression from adolescence to early adulthood: Effortful control in the context of friendship influence and early-onset use. *Journal of Abnormal Child Psychology, 40*(7), 1045–1058. doi: 10.1007/s10802-012-9626-7

Posner, M. I., & Rothbart, M. K. (2007). *Educating the human brain*. Washington, DC: American Psychological Association.

Raver, C. C., Jones, S. M., Li-Grining, C., Zhai, F., Bub, K., & Pressler, E. (2011). CSRP's impact on low-income preschoolers' preacademic skills: Self-regulation as a mediating mechanism. *Child Development, 82*(1), 362–378.

Robertson, D. L., & Reynolds, A. J. (2010). Family profiles and educational attainment. *Children and Youth Services Review, 32*(8), 1077–1085.

Robins, R. W., John, O. P., Caspi, A., Moffitt, T. E., & Stouthamer-Loeber, M. (1996). Resilient, overcontrolled, and undercontrolled boys: Three replicable personality types. *Journal of Personality and Social Psychology, 70*(1), 157–171. doi: 10.1037/0022-3514.70.1.157

Ross, C. E., & Mirowsky, J. (2006). Sex differences in the effect of education on depression: Resource multiplication or resource substitution? *Social Science & Medicine, 63*(5), 1400–1413.

Rothbart, M. K., & Bates, J. E. (1998). Temperament. In N. Eisenberg (Ed.), *Handbook of child psychology, Vol 3. Social, emotional, and personality development* (5th ed., pp. 105–176). Hoboken, NJ: John Wiley & Sons Inc.

Rothbart, M. K., Ellis, L. K., & Posner, M. I. (2011). Temperament and self-regulation. In K. D. Vohs & R. F. Baumeister (Eds.), *Handbook of self-regulation: Research, theory, and applications* (2nd ed., pp. 441–460). New York, NY: Guilford Press.

Rumberger, R. W. (1987). High school dropouts: A review of issues and evidence. *Review of Educational Research, 57*(2), 101–121.

Ryan, A. K. (2010). The lasting effects of marijuana use on educational attainment in midlife. *Substance Use & Misuse, 45*(4), 554–597. doi: 10.3109/10826080802490238

Sahdra, B. K., MacLean, K. A., Ferrer, E., Shaver, P. R., Rosenberg, E. L., Jacobs, T. L., . . . Saron, C. D. (2011). Enhanced response inhibition during intensive meditation training predicts improvements in self-reported adaptive socioemotional functioning. *Emotion, 11*(2), 299–312. doi: 10.1037/a0022764

Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural

equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research, 8*(2), 23–74.

Somech, L. Y., & Elizur, Y. (2012). Promoting self-regulation and cooperation in pre-kindergarten children with conduct problems: A randomized controlled trial. *Journal of the American Academy of Child and Adolescent Psychiatry, 51*(4), 412–422.

South, S. J., Baumer, E. P., & Lutz, A. (2003). Interpreting community effects on youth educational attainment. *Youth and Society, 35*(1), 3–36.

Steinberg, L., Lamborn, S. D., Dornbusch, S. M., & Darling, N. (1992). Impact of parenting practices on adolescent achievement: Authoritative parenting, school involvement, and encouragement to succeed. *Child Development, 63*(5), 1266–1281. doi: 10.2307/1131532

Stormshak, E. A., Connell, A., & Dishion, T. J. (2009). An adaptive approach to family-centered intervention in schools: Linking intervention engagement to academic outcomes in middle and high school. *Prevention Science, 10*(3), 221–235.

Stormshak, E. A., Fosco, G. M., & Dishion, T. J. (2010). Implementing interventions with families in schools to increase youth school engagement: The Family Check-Up model. *School Mental Health, 2*(2), 82–92. doi: 10.1007/s12310-009-9025-6

Tang, Y.-Y., Ma, Y., Wang, J., Fan, Y., Feng, S., Lu, Q., . . . Posner, M. I. (2007). Short-term meditation training improves attention and self-regulation. *PNAS Proceedings of the National Academy of Sciences of the United States of America, 104*(43), 17152–17156. doi: 10.1073/pnas.0707678104

Taylor, J. L., Hurd, H. D., Seltzer, M. M., Greenberg, J. S., & Floyd, F. J. (2010). Parenting with mild intellectual deficits: Parental expectations and the educational attainment of their

children. *American Journal on Intellectual and Developmental Disabilities, 115*(4), 340–354.

Tobiasz-Adamczyk, B., Bartoszewska, E., Brzyski, P., & Kopacz, M. (2007). Long-term consequences of education, working conditions, and health-related behaviors on mortality patterns in older age: A 17-year observational study in Kraków, Poland. *International Journal of Occupational Medicine and Environmental Health, 20*(3), 247–256.

Valiente, C., Lemery-Chalfant, K., & Swanson, J. (2010). Prediction of kindergartners' academic achievement from their effortful control and emotionality: Evidence for direct and moderated relations. *Journal of Educational Psychology, 102*(3), 550–560. doi: 10.1037/a0018992

Valiente, C., Lemery-Chalfant, K., Swanson, J. & Reiser, M. (2008). Prediction of children's academic competence from their effortful control, relationships, and classroom participation. *Journal of Educational Psychology, 100*(1), 67–77.

Van Ryzin, M. J., & Dishion, T. J. (2012). The impact of a family-centered intervention on the ecology of adolescent antisocial behavior: Modeling developmental sequelae and trajectories during adolescence. *Development and Psychopathology, 24*(3), 1139–1155. doi: 10.1017/s0954579412000582

Véronneau, M.-H., Dishion, T. J., & Connell, A. (2013). *The long-term outcomes of the Family Check-Up model in public secondary schools: A randomized clinical trial linking parent engagement to the progression of substance use from early adolescence to adulthood.* Manuscript under review.

Véronneau, M.-H., Vitaro, F., Pedersen, S., & Tremblay, R. E. (2008). Do peers contribute to the likelihood of secondary school graduation among disadvantaged boys? *Journal of Educational Psychology, 100*(2), 429–442. doi: 10.1037/0022-0663.100.2.429

Widaman, K. F. (2006). Best practices in quantitative methods for developmentalists: III. Missing data: What to do with or without them. *Monographs of the Society for Research in Child Development, 71*(3), 42–64. doi: 10.1111/j.1540-5834.2006.00404.x

Wolfe, R. N., & Johnson, S. D. (1995). Personality as a predictor of college performance. *Educational and Psychological Measurement, 55*(2), 177–185. doi: 10.1177/0013164495055002002

Zhang, J.-P., Huang, H.-S., Ye, M., & Zeng, H. (2008). Factors influencing the subjective well being (SWB) in a sample of older adults in an economically depressed area of China. *Archives of Gerontology and Geriatrics*, *46*(3), 335–347.

Zhou, Q., Main, A., & Wang, Y. (2010). The relations of temperamental effortful control and anger/frustration to Chinese children's academic achievement and social adjustment: A longitudinal study. *Journal of Educational Psychology, 102*(1), 180–196. doi: 10.1037/a0015908

Table 1. Descriptive Statistics and Bivariate Correlations

	1	2	3	4	5	6	7	8	9	10	11	12
1. Educational attainment	—											
2. Family SES	.32***	—										
3. Parental education	.45***	.42***	—									
4. Early problem behavior	-.28***	-.19***	-.23***	—								
5. Positive family involvement: positive relations	.11**	.01	.01	-.29***	—							
6. Positive family involvement: parental monitoring	.22***	.12***	.19***	-.53***	.51***	—						
7. Positive family involvement: homework rule	.11**	-.001	.05	-.25***	.30***	.33***	—					
8. Substance use	-.15***	.02	.02	.27***	-.18***	-.19***	-.16***	—				
9. CGPA	.60***	.39***	.40***	-.30***	.12**	.26***	.11**	-.19***	—			
10. Effortful control–self	.12***	-.09*	-.004	-.15***	.21***	.17***	.12***	-.16***	.12***	—		
11. Effortful control–parent	.27***	.06	.03	-.18***	.18***	.19***	.06	-.21***	.37***	.34***	—	
12. Effortful control–teacher	.45***	.25***	.22***	-.23***	.09*	.20**	.06	-.17***	.57***	.20***	.41***	—
Mean	2.65	.01	3.94	1.40	3.47	3.97	3.38	.73	2.17	3.35	3.30	3.72
SD	.90	.75	.97	.48	.86	.80	.62	1.13	1.08	.48	.54	.79
n	855	726	706	997	997	997	995	792	884	792	684	666
Skew	-.15	-1.04	-.82	2.43	-.34	-.94	-1.17	1.72	-.16	.26	-.20	-.18
Kurtosis	-.74	.41	.31	8.08	-.46	.57	1.37	2.17	-.86	.34	-.03	-.56

Note. *$p < .05$, **$p < .01$, *** $p < .001$.

Table 2. Estimated Correlation Matrix for the Latent Variables

	1	2	3	4	5	6	7	8
1. Educational attainment	—							
2. Family SES	.34***	—						
3. Parental education	.48***	.42***	—					
4. Early problem behavior	–.32***	–.21***	–.25***	—				
5. Positive family involvement	.25***	.09*	.16***	–.59***	—			
6. Substance use	–.17***	.02	.02	.29***	–.27***	—		
7. CGPA	.64***	.40***	.41***	–.33***	.27***	–.19***	—	
8. Effortful control	.59***	.21***	.20***	–.37***	.32***	–.32***	.71***	—

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

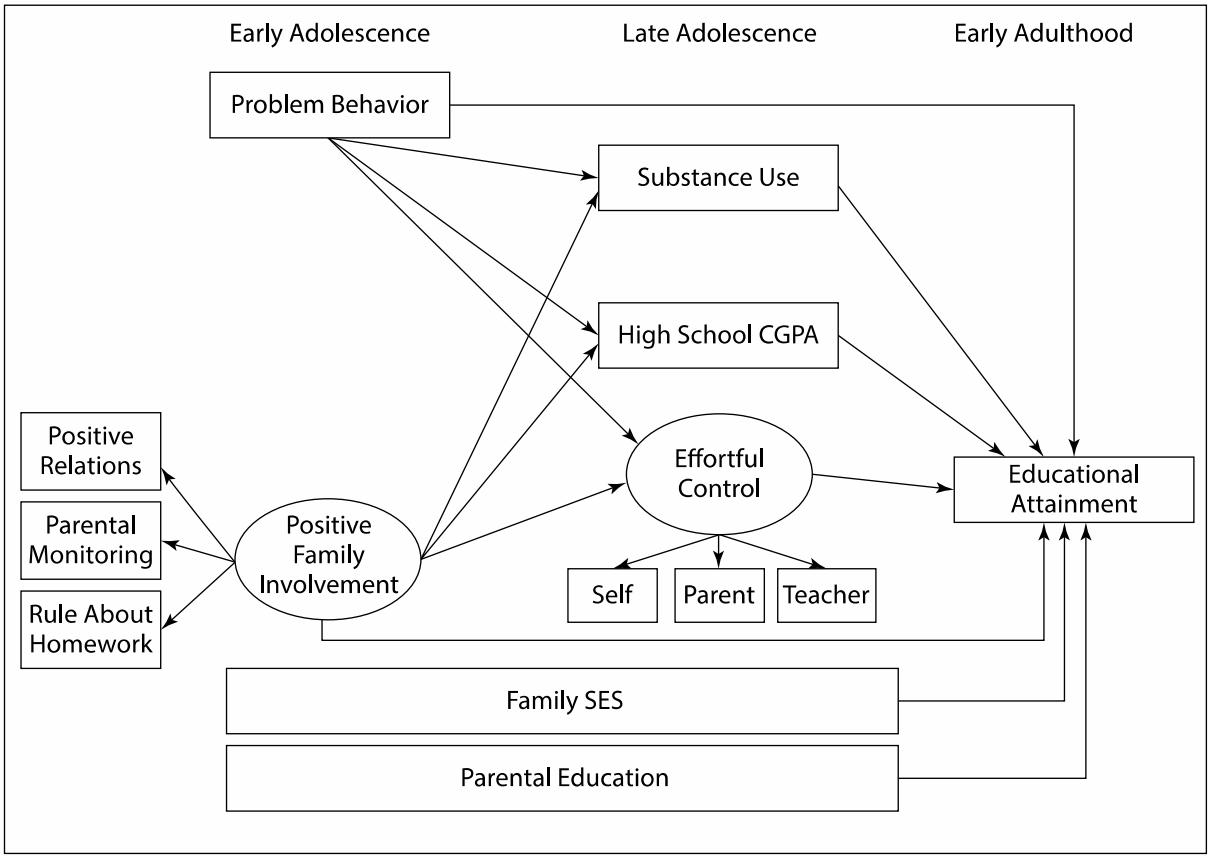

Figure 1. Full model. Correlations among predictors measured within the same developmental period were also included in the model, even if they are not depicted here. Correlations between family SES and parental education, and between these variables and the five other predictors, were included.

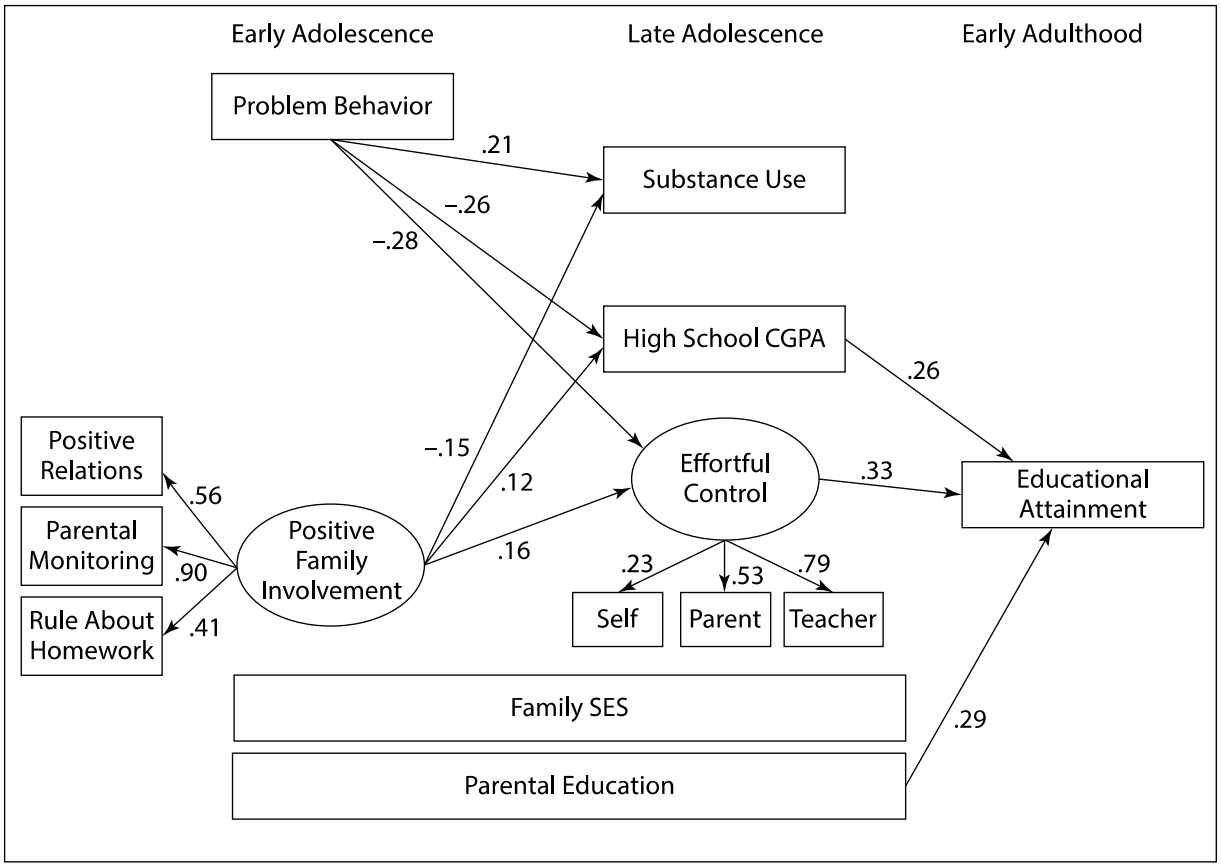

Figure 2. Model results (regression paths and factor loadings). Coefficients are standardized. All solid paths are significant at $p < .05$ or smaller. Other regression paths mentioned in Figure 1 that are not depicted here were included in the SEM analyses but were not significant.