



Published in final edited form as:

Dev Psychol. 2008 November ; 44(6): 1519–1536. doi:10.1037/a0013352.

Adolescent Family Experiences and Educational Attainment during Early Adulthood

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Abstract

This study investigated the degree to which a family investment model would help account for the association between family of origin socioeconomic characteristics and the later educational attainment of 451 young adults (age 26) from two-parent families. Parents' educational level, occupational prestige, and family income in 1989 each had a statistically significant direct relationship with youths' educational attainment in 2002. Consistent with the theoretical model guiding the study, parents' educational level and family income also demonstrated statistically significant indirect effects on later educational attainment through their associations with growth trajectories for supportive parenting, sibling relations, and adolescent academic engagement. Supportive parenting and sibling relations were linked to later educational attainment through their association with adolescent academic engagement. Academic engagement during adolescence was associated with educational attainment in young adulthood. These basic processes operated similarly regardless of youths' gender, target youths' age relative to a near-age sibling, gender composition of the sibling dyad, or gender of parent.

Keywords

educational attainment; academic engagement; parenting; sibling relations; SES

Substantial evidence indicates that the number of years of formal schooling completed by early adulthood is associated with young adults' initial labor market status and income (Bjarnason,

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2000), later occupational success (Blau & O. D. Duncan, 1967; Chand, Crider, & Willits, 1983), and life satisfaction and healthy aging in general (Meeks & Murrell, 2001). Prior research identifies relationships between youth educational outcomes and family of origin characteristics such as parental support and family income (e.g., Best, Hauser, & Allen, 1997; Brooks-Gunn, G. J. Duncan, & Aber, 1997; Furstenberg, Eccles, Elder, Cook, & Sameroff, 1999; Melby & R. D. Conger, 1996; Sieben & DeGraaf, 2003). Recent literature also suggests that siblings may be associated with youth educational outcomes (G. J. Duncan, Boisjoly, & Harris, 2001). Less is known, however, about the combined effects of these family factors on educational attainment (Connell & Halpern-Felsher, 1997). Moreover, despite considerable evidence for the effects of socioeconomic factors on parenting and child development (e.g., see Bornstein & Bradley, 2003; Brooks-Gunn & Duncan, 1997; R. D. Conger & Dogan, 2007; McLoyd, 1998; White, 1982), there is increasing awareness of the need to identify possible family pathways through which specific indicators of socioeconomic status (SES) are related to eventual academic and occupational success (Bradley & Corwyn, 2002; Conger & Donnellan, 2007; Lerner, 2003; McLoyd, 1998). We address these issues and extend the existing literature by evaluating a conceptual model which proposes that family SES will be associated both directly and indirectly with adult educational attainment.

The Conceptual Model

We draw on what Conger and his colleagues have called the *family investment model* to develop the conceptual framework for the present study (R. D. Conger & Dogan, 2007; R. D. Conger & Donnellan, 2007). According to the investment model, family SES in the form of parental income, education, and occupational status is positively related to parental investments in children. These investments can take many forms but center especially on parental support for creating a family environment that fosters the development of human capital for children. Although there is growing recognition of the dynamic nature of the relationships among family characteristics and educational outcomes (e.g., Crosnoe, 2004; Crosnoe, Mistry, & Elder, 2002), ours is the first known application of the investment model to the issue of early adult educational attainment, as illustrated in Figure 1. Specifically, we propose that family *socioeconomic characteristics* will affect later *educational attainment* both directly and indirectly through their influence on interpersonal relationships in the family and adolescent engagement in academic pursuits. Supportive parenting and positive sibling relationships, which constitute direct investments in a family environment that fosters the academic success of children, are hypothesized to influence *academic engagement* during early and mid adolescence prior to the transition to adulthood. Adolescent academic engagement is proposed to be the primary pathway through which these family characteristics affect eventual educational attainment. We next describe the theoretical and empirical underpinnings for each path in the conceptual model.

Socioeconomic Characteristics and Educational Attainment

Extensive previous research across a range of studies has shown that family socioeconomic status (SES) is associated with child outcomes. In our model, family *socioeconomic characteristics* are proposed to have statistically significant direct relationships with *educational attainment* in young adulthood (Path a in Figure 1; e.g., Ensminger & Fothergill, 2003; Hill & G. J. Duncan, 1987; Hollingshead, 1975; Travis & Kohli, 1995). The support for this path derives from the accumulating evidence that access to “capital” in the form of more highly educated parents in higher status occupations with above average incomes facilitates subsequent pursuit of advanced education (e.g., see Coleman, 1988; Lin, 2001; McLoyd, 1998). These effects are believed to result from the initial and cumulative opportunities associated with greater economic resources (e.g., G. J. Duncan & Magnuson, 2003; Mayer, 1997). Although we propose that SES will be indirectly related to educational attainment

through family and academic experiences during adolescence, we also include the direct path from SES to attainment because parents serve as role models for pursuing advanced education and also provide access to interpersonal and economic resources that facilitate the acquisition of additional years of schooling. That is, the interpersonal processes proposed in the model in Figure 1 only are concerned with the relationship aspects of the family investments. SES also increases monetary investments in children that facilitate continued education and these unmeasured resources are captured by path a in the model.

There is considerable evidence of the effects of SES on educational outcomes. For example, in a meta-analysis of almost 200 studies, White (1982) identified an average correlation between family SES and youth academic achievement of .22. A more recent meta-analysis of this relationship by Sirin (2004) using over 50 studies published between 1999 and 2000 found an average correlation of .29. As noted by Oakes and Rossi (2003), however, the interpretation of SES effects is complicated by the disparate ways in which SES has been assessed. We are especially interested in the direct effects of three frequently used markers of SES on educational outcomes. There is ample support that *parents' education* (amount of formal education) is associated with greater educational attainment by children (e.g., Blau & O. D. Duncan, 1967; Haveman, Sandefur, Wolfe, & Voyer, 2004). Although the extent of the association varies, several studies suggest a positive relationship between parents' education and youths' years of schooling completed (G. J. Duncan, Yeung, Brooks-Gunn, & Smith, 1998; McLoyd, 1998; Tomlinson-Keasey, & Little, 1990). For example, using data from the Children of the National Longitudinal Surveys of Youth data set, mother educational attainment and youth college enrollment at age 20-22 years correlated .21 (McLeod & Kaiser, 2004). In other research, educational attainment for parents and youth age 28-29 years correlated .44 (Benin & Johnson, 1984). In terms of *family income*, evidence suggests that family income has a modest relationship with academic achievement during childhood but has a more robust relationship with academic attainment in adulthood (G. J. Duncan & Brooks-Gunn, 1997). The connection between poverty and lower educational attainment among children and adolescents has been well documented (e.g., Crosnoe, Mistry, & Elder, 2002; McLanahan, 1985; McLeod & Kaiser, 2004; McLoyd, 1998; Sewell & Hauser, 1980). *Parents' occupational status* has long been associated with variation in children's educational assessments (Biblarz & Raftery, 1999; Korupp, Ganzeboon, & Van Der Lippe, 2002). Occupational status for both mothers and fathers is related to children's eventual educational attainment. For example, fathers' occupational status measured using Duncan's Socioeconomic Index and youths' educational attainment at age 28-29 years correlated .47 (Benin & Johnson, 1984). Moreover, mother's occupational status has been shown to have a strong effect on children's schooling, independent of father's education and occupation (Kalmijn, 1994). Finally, in terms of the relative strength of the relationship of the three SES indicators with academic achievement, White's (1982) meta-analyses identified family income as the highest correlate, followed by parental occupation and parental education. In the next section we consider the hypothesized indirect pathways through which SES is associated with educational attainment.

Mechanisms of SES Influence

As previously noted, in addition to proposing direct effects of SES on educational attainment, we draw upon the family investment model (R. D. Conger & Donnellan, 2007) to predict that the effects of SES on educational attainment will operate indirectly through several mediating variables. This prediction is consistent with McLoyd's (1998) extensive review of the literature which shows that the link between socioeconomic disadvantage and child outcomes appears to be mediated partially by harsh, inconsistent parenting. Our model also is consistent with work by Schoon et al. (2002) and by Crosnoe and associates (2002, 2004) which examine processes through which social inequalities experienced during childhood are associated with

adult achievements. We next discuss the effects of SES on each mediator of the relationship between SES and educational attainment as proposed in our theoretical model.

SES effects on supportive parenting and positive sibling relationships—

According to the *family investment model*, higher compared to lower SES parents are more likely to commit time, energy and support in raising their children. Moreover, they are especially likely to place an emphasis on academic success and to create a richer learning environment for their children (R. D. Conger & Donnellan, 2007). Consistent with this perspective, in our model family socioeconomic characteristics are expected to have a statistically significant direct effect on both the initial level and changes in *supportive parenting behaviors* (Path b in Figure 1). This theoretical prediction is consistent with a multitude of empirical findings demonstrating a positive association between family SES and specific qualities of parenting behaviors that foster learning and academic success (for recent reviews see R. D. Conger & Dogan, 2007 and R. D. Conger & Donnellan, 2007). For example, family resources such as higher parental income, education, and occupational status are associated with the quality of parenting (Bornstein & Bradley, 2003). Such advantages appear to promote supportive and inhibit hostile parental behaviors toward an adolescent child (Cui, Conger, Bryant, & Elder, 2002). In the current model, however, we extend the usual investment perspective by proposing that SES affects not only parents but also siblings and the degree to which they promote one another's academic involvements.

In the model, SES is proposed to be directly related to both the initial level and change in the quality of *sibling relations* (Path c in Figure 1; e.g., Dunn, 2007; Dunn, Slomkowski & Bearsall, 1994; Hao & Matsueda, 2006; MacKinnon, 1988). Compared with those from lower SES families, 12-13 year old siblings from higher SES families reported more warmth and intimacy in relationships with siblings (Dunn, 1996). Research with youth ages 19-33 years demonstrated that stressful family economic conditions are associated with less overall sibling communication and more sibling conflict (Milevsky, Smoot, Leh, & Ruppe, 2005). We propose that SES leads to a family environment that is generally more positive with regard to academic efforts, and for that reason add sibling relationships to the investment model.

SES effects on adolescent academic engagement—We also predict a direct relationship between SES and adolescent academic engagement (Path d, Figure 1; e.g., Ensminger & Slusarcick, 1992; Rabusicova, 1995). Academic engagement in our model is defined as a youth's positive attitude toward school, confidence in own ability to do well in school, and perception of and actual success in school (Anderson, Christenson, Sinclair, & Lehr, 2004; Connell, Spencer, & Aber, 1994). Research by Schoon et al. (2002) using data from two national birth cohorts in Britain found lower family of origin SES (assessed by occupational status) was related to lower academic adjustment and performance in childhood and adolescence, which in turn was associated with lower SES when these youth were in their 30s. Other support for this prediction comes from evidence previously cited for the effects of SES on educational outcomes. As with the direct path from SES to later educational attainment, we include the direct path to academic engagement to accommodate the expected influence of unmeasured investments related to SES, such as funds for extracurricular educational experiences such as tutoring and enrollment in special educational programs beyond normal schooling (R. D. Conger & Donnellan, 2007).

Effects of Family Interpersonal Relationships

The next step in the proposed model involves the role of family relationships in promoting academic engagement. Because earlier research suggests that parents and siblings have unique effects on many domains of adolescent development (Bank et al., 2004; K. J. Conger, R. D.

Conger, & Scaramella, 1997; Crosnoe & Elder, 2004; Moser & Jacob, 2002), we propose additive influences on engagement for parenting behaviors and sibling relations.

Supportive parenting behaviors—Much previous research has demonstrated an association between type of parenting and adolescents' school-related success (Path f in Figure 1; e.g., Steinberg, Lamborn, Dornbusch, & Darling, 1992). Parents affect youths' academic confidence (Rodgers & Rose, 2001) and school adjustment (Ingoldsby, Shaw, & Garcia, 2001). Authoritarian parents tend to have adolescent children with a lower grade-point-average (GPA), whereas authoritative parenting is positively associated with school performance (Dornbusch, Ritter, Leiderman, Roberts, & Fraleigh, 1987; Steinberg, Mounts, Lamborn, & Dornbusch, 1991). Authoritative parenting positively relates to adolescents' better peer relationships (Chen, Dong, & Zhou, 1997) and adolescents' greater engagement in school (Steinberg et al., 1992). The primary conclusion from research in this area is that parents who are supportive and communicate well with their children, are involved in their children's lives, and who refrain from harsh and angry exchanges with their children will have offspring who tend to be more engaged and successful in academic pursuits (Conger & Donnellan, 2007; Melby & Conger, 1996; Crosnoe, 2004).

Positive sibling relations—Although there has been little research on the possible effect of siblings on academic outcomes, there is growing recognition of the importance of siblings and sibling relationships for child and adolescent development. Siblings often provide advice and guidance about competent behaviors (Bryant, 1989; Dunn, 1996), as well as support and companionship (Cicirelli, 1980; K. J. Conger, R. D. Conger, & Elder, 1994; Goetting, 1986; Tucker, McHale, & Crouter, 2001). Recent evidence suggests that sibling influences may extend to school-related success, as hypothesized in Path g in Figure 1 (e.g., G. J. Duncan et al., 2001). For example, Amato (1989) found that positive qualities of sibling relations, as well as parenting, were associated with adolescent school-related competencies in several areas that could influence academic performance. His study showed that adolescents who interact positively with siblings at home are more likely to enjoy aspects of school life such as positive peer interactions and learning. In addition, Brody, Stoneman, Smith, and Gibson (1999) found that self-regulated children tend to have lower conflict with siblings, which may indirectly impact success in school. Thus, we suggest that the quality of both parenting and sibling relationships will be associated with adolescent academic engagement. That is, positive and supportive parental and sibling relations are expected to be related to youth's positive attitude toward school, confidence in own ability to do well in school, and perception of and actual school success.

Joint effects of family relationships—Parent and sibling relationships are intertwined, however, and evidence from multiple investigations suggests that parenting is associated with the quality of sibling relations (Path h in Figure 1; e.g., MacKinnon-Lewis, Starnes, Volling, & Johnson, 1997; McHale, Updegraff, Tucker, & Crouter, 2000; Volling & Belsky, 1992). Compared with mothers who were less rejecting, middle-childhood sibling dyads whose mothers were more rejecting were more aggressive in their interactions (MacKinnon-Lewis et al., 1997). Additionally, parental hostility increased conflict between siblings which, in turn, was associated with emotional and behavioral problems for a target adolescent (K. J. Conger, R. D. Conger, & Elder, 1994).

Other evidence points to both unique and cumulative effects of negative relationships with parents and siblings on school adjustment (Brown, 2004; R. D. Duncan, 1999). For example, negative parent and sibling relations were independently associated with poor relationships with teachers and peers for preschoolers (Ingoldsby et al., 2001; Vondra, Shaw, Swearingen, Cohen, & Owens, 1999). If similar processes occur during adolescence, the effects of multiple negative family relationships could impact later academic outcomes. Amato (1989) found that

as children enter adolescence, their general competency becomes more closely associated with the degree of parental control and the quality of sibling relations. Thus, there is reason to believe that in addition to the unique effects of parenting and siblings on adolescent outcomes, parenting behavior is related to the quality of sibling relations in a manner that may have important implications for adolescent development, including academic engagement. In the model we hypothesize that the effects of family interpersonal relationships on educational attainment at young adulthood will operate through academic engagement during adolescence.

Direct effects of Academic Engagement

As a final step in the hypothesized causal processes, our model proposes a statistically significant direct association between adolescent academic engagement and educational attainment (Path e in Figure 1; Wang, Kick, Fraser, & Burns, 1999). Previous research demonstrates an association between attachment to school and school performance (e.g., Cernkovich & Giordano, 1992; Juang & Silbereisen, 2002; Wade & Brannigan, 1998) and between school motivation and academic achievement (Guo, 1998; Pintrich, 2000; Roeser, Eccles, & Sameroff, 1998; Wentzel & Feldman, 1993). Recently, Marjoribanks (2006) found that adolescent cognitive habitus, conjointly defined by adolescent academic achievement and attitudes about school, was related to their educational attainment as young adults. The previously cited study by Schoon et al. (2002) also found lower academic adjustment and performance in childhood and adolescence to be associated with lower SES when youth reached adulthood. Overall, these earlier research findings are consistent with path e in the conceptual model. The goal of the present study is to evaluate the empirical credibility of the proposed conceptual framework by using data from an ongoing cohort study of youth from early adolescence to the early adult years.

Addressing Limitations in Earlier Research

In addition to being the first to test a specific form of the *family investment model* as it relates to educational attainment, the current study also addresses several limitations in the research literature. Despite considerable past research suggesting that parent socioeconomic status, parenting, and sibling relationships influence adolescent academic outcomes, there are several limitations in most of this work. *First*, few studies have examined, in the same analysis, the joint effects of parent-child and sibling relationships on educational attainment. The current study addresses this gap in the literature by including both parents and siblings in the proposed model. *Second*, much previous research examining family processes and developmental outcomes has used retrospective data that are affected by recall bias resulting from memory failure and the subjectivity of the issue in question (e.g., Aquilino, 1997; Barber, 1994; Henry, Moffitt, Caspi, Langley, & Silva, 1994; Rueter, Chao, & R. D. Conger, 2000). We use a prospective longitudinal research design that allows us to examine predictor and outcome variables in the correct temporal order without retrospective reports.

Third, in contrast to investigations that use a single measure of socioeconomic status, we examine three separate components—parent education, occupation, and income. Although frequently combined into a single measure of SES, recent evidence suggests that the extent of influence by individual markers of SES may shift over the course of the lifespan (see Warren, Hauser, & Sheridan, 2002), vary according to the outcome assessed (e.g., see G. J. Duncan, Yeung, Brooks-Gunn, & Smith, 1998), and operate somewhat differently depending on culture and ethnicity (Bradley & Corwyn, 2003; McLoyd, 1998). Furthermore, given the lack of uniformity in measurement of SES (Oakes & Rossi, 2003), a number of scholars suggest separating SES into these three frequently used quantitative indicators in order to help understand the independent effects of each of them (R. D. Conger & Dogan, 2007; Corwyn & Bradley, 2005; G. J. Duncan & Magnuson, 2003; Ensminger & Fothergill, 2003). Assessing their unique effects is particularly warranted when evaluating change over time (Bornstein,

Hahn, Suwalsky, & Haynes, 2003; Warren et al., 2002). This allows us to assess differential associations of these exogenous variables with our endogenous variables.

Fourth, many past investigations of sibling effects have primarily focused on structural factors (e.g., birth order, number of siblings, etc.) and achievement factors (e.g., siblings' GPA) as opposed to relationship dimensions (e.g., see Hauser, Sheridan, & Warren, 1999; Sandefur & Wells, 1999; Sieben & DeGraaf, 2003). While structural factors are important considerations, there is reason to focus on the quality of the sibling dyad's interpersonal relations as a potential influence on educational attainment (K. Conger, Bryant, & Brennom, 2004). *Fifth*, earlier longitudinal analyses typically used traditional regression, including auto-regressive techniques (e.g., Melby & R. D. Conger, 1996; Rodgers & Rose, 2001; Steinberg et al., 1992), which are insensitive to intra-individual differences in change over time. A proper analysis of change requires the examination of specific changes within individuals over time (Rogosa, Brand, & Zimowski, 1982). Therefore, we use growth curve analysis to examine both the absolute levels and individual changes in attributes over time (T. Duncan, S. Duncan, Stryker, Fuzhong, & Alpert, 1999; Willett & Sayer, 1994). *Sixth*, we used multiple informants in the present investigation to improve on past research into family process effects on educational attainment that used single reporters (e.g., Bean, Barber, & Crane, 2006; Bowen, Bowen, & Ware, 2002), thereby reducing bias by using different reporters for adjacent constructs (Bank, Dishion, Skinner, & Patterson, 1990; Lorenz, Conger, Simons, Whitbeck, & Elder, 1991).

Method

Participants and Procedures

Data for these analyses come from a longitudinal study of 451 two-biological-parent intact families in North Central Iowa that began in 1989 when the youth who are the focus of the study ("targets") were in the 7th grade; 52.3% (236) of the targets were female (R. D. Conger & K. J. Conger, 2002; R. D. Conger, & Elder, 1994). Participants were primarily white, lower middle and middle class who resided on farms (34%), non-farm rural areas (12%) or towns under 6,500. The median ages of the fathers, mothers, and target adolescents in 1989 were 39, 37, and 13 years. The study included a near-age sibling, either older (220) or younger (231) than the target adolescent by within four years. Median family size and annual income at the first year of data collection were 4.95 and \$33,000, respectively. We use data collected across a fourteen-year period (1989-2002). Of the original sample, 422 targets (93.6%) remained in the study in 2002. The 422 target youth in the final sample included 193 boys and 229 girls; of the siblings, 205 were older and 217 were younger than the target. In order to maximize analytic power and to avoid biased findings caused by listwise or pairwise deletion or by mean imputation (Vargas-Chanes, 2000), we employed *Expectation Maximization* imputation methods (SPSS) to impute data for the explanatory variables.

To evaluate the effects of sample attrition, we compared the means of all first year (1989) study variables for participants who remained in the study with the 29 who were no longer in the sample in 2002. Statistically significant differences were evident for one variable: adolescent gender. In terms of adolescent gender (coded so that *male* = 1, *female* = 0), girls were more likely to remain in the study than boys ($t = -3.17$). None of the other study variables showed statistically significant mean differences.

During the initial four years of the study (1989-1992), when youth were on average 13-16 years of age, interviews took place each year in participants' homes; family members were visited twice by trained interviewers with each visit lasting approximately two hours. Each participating family member independently filled out questionnaires that asked for detailed information about family life, work, school, finances, friends, and physical and mental health.

During the second visit, usually within 2 weeks of the first, the four participating family members were videotaped while engaged in a parent-child discussion task, which lasted about 30 minutes. After completing the instructions for the task, the interviewer and any family members not involved in the task left the room in order to allow the participating family members privacy during their video recorded interaction. Each family member was paid about \$10 per hour for participation. Trained observers scored videotapes using the *Iowa Family Interaction Rating Scales* (Melby & R. D. Conger, 2001). Approximately 25% of the tasks were independently rated by a second observer to assess interrater reliability. Additional details regarding study procedures are available in R. D. Conger and Elder (1994).

In the fourteenth year of the study (2002), when the target youth averaged age 26 years, telephone interviews were conducted with the target youth to obtain information about their current demographic characteristics, including level of educational attainment, using procedures similar to those used in previous years of data collection when no home visits were scheduled (see also R. D. Conger & K. J. Conger, 2002).

Measures

To maintain the correct temporal order for variables indicated in the conceptual model (Figure 1), socioeconomic characteristics assessed in 1989 constituted the exogenous variables in the analyses. Measures of family relationships were used from 1989, 1990, and 1991; and measures of academic engagement came from interviews conducted in 1990, 1991, and 1992. Finally, the criterion measure of educational attainment was obtained in 2002, when target young adults averaged 26 years of age.

Socioeconomic status measures—We identify three separate components of socioeconomic status. To evaluate *parents' education*, we asked parents to report their years of formal education. Father and mother reports correlated $r = .46$ and the average of the two scores was taken as the measure of parental education ($\bar{X} = 13.38$, $SD = 1.62$).

To obtain a measure of *family per capita income* in these two-parent households, parents' self report in 1989 of income received from all sources during the preceding year was divided by the number of members living in the household. To be eligible to participate in the study, all families had a minimum of two biological children. Family size ranged from 4 to 14, with mean of 4.95 members; family income ranged from a net loss to over \$100,000. For the per capita income measure, $\bar{X} = \$7,990$ and $SD = \$5,654$. Because the per capita income measure was highly skewed, the natural log-transform of this variable was used in these analyses ($\bar{X} = 11.38$, $SD = 0.06$); use of the natural log of income is supported by past research (Mayer, 1997). Using a per capita income measure rather than total household income helps account for possible effects of number of siblings on the relationship between family economic resources and youth educational attainment (see Haverman, et al., 2004; Marks, 2006; Schoon & Parsons, 2002).

The fathers' and mothers' self-reports of occupational title and activities in 1989 were used to classify their *occupational prestige* following procedures by Nakao and Treas (1990) in which a prestige score is derived from a particular occupational title based on education and income typically associated with a given occupational title. Although father's occupational prestige traditionally has been used as a predictor of child outcomes (e.g., see Blau & O. D. Duncan, 1967), researchers also note the importance of mother's occupational status in predicting children's educational attainment (Khazzoom, 1997; Korupp et al., 2002). Following from Erikson (1984) and Kalmijn (1994), for the present analyses we used the higher of the two parents' prestige scores to indicate occupational prestige ($\bar{X} = 47.37$, $SD = 11.99$). This measure has a possible range of 1 to 99 with 99 indicating the highest possible score on occupational prestige; for fathers $\bar{X} = 41.83$, $SD = 11.87$ and for mothers $\bar{X} = 38.42$, $SD = 14.41$. The zero-

order correlation between fathers' and mothers' occupational prestige score was $r = .08$ (not statistically significant).

Supportive parenting—Observer ratings of parental behaviors displayed toward the adolescent during the video recorded parent-child discussion tasks in 1989, 1990, and 1991 were used to measure parenting. At each year, parents were rated on eleven different behaviors using a scale from $1 = \textit{not at all characteristic}$, to $9 = \textit{mainly characteristic}$. Some ratings were reverse coded so that a higher score indicated more supportive parenting. Across the three years, the means were 5.97, 5.56, and 5.20, respectively.

The behavioral ratings included in the *supportive parenting* construct were: communication, assertiveness, prosocial, warmth/support, listener responsiveness, inductive reasoning, encourages independence, and reverse-coded hostility, antisocial, angry coercion, and indulgent/permissive. Each parent's behavior in the parent-child discussion task was rated and the scores summed to create separate father-parenting and mother-parenting scores; the internal consistencies among items for mothers were .85, .88, and .87 and for fathers were .85, .87, and .84, respectively, at each of the three time-points. The correlations between summed parenting scores for father and mother were .50, .63, and .61, respectively, at the three time-points. Because of our interest in assessing family processes, the means from each parent were averaged to create an observed parenting measure for the family at each time-point. Thus, on balance, parents who are supportive in interactions with their child display high levels of nurturance and low levels of denigration. By including positive and reverse-coded negative parenting behaviors, as well as behaviors of both fathers and mothers, we more broadly characterize the parenting environment experienced by the adolescent. The internal consistencies among the scales measuring supportive parenting at each of the three years, respectively, were .66, .77, and .76.

By testing the hypothesized model using observer ratings as an independent source of information on supportive parenting, we eliminate a potential source of error variance. We used separate reporters to reduce possible rater-bias caused when the same reporters are used to assess measures of adjacent constructs (i.e., supportive parenting and academic engagement; see Bank et al., 1990; Lorenz & Melby, 1994; Pelegrina, Garcia-Linares, & Casanova, 2003). Although adolescent reports on parental supportiveness were not included as part of the present analyses, the zero-order correlations between adolescent report and observer rating of supportive parenting across the three years were .25, .29, and .32, consistent with evidence from other research (Feinberg, Neiderhiser, Howe, & Hetherington, 2001). Parent self-report measures for these constructs were not available at each of the three years included in these analyses.

Sibling relations—At each of the first three years (1989, 1990, and 1991), siblings responded to 23 questionnaire items regarding their interaction with the target adolescent (e.g., “Do you two insult or call each other names?”, “Do you two try to out-do or beat each other at things?”, “Do you two share things with each other?” etc.). These items were adapted from the Sibling Relationship Questionnaire (Furman & Buhrmester, 1985). Each item was measured on a scale from $1 = \textit{often}$, to $4 = \textit{never}$; all items were coded such that a higher mean score indicates more positive sibling relations. The internal consistencies for the three years were .88, .90, and .90 respectively. Again, the use of multiple informants, for example sibling report for the quality of sibling relations and target report for academic engagement, assures that any observed association between the two constructs is unlikely to reflect a method bias.

Academic engagement—Building upon approaches to defining role engagement (e.g., see Reitzes, 2003) and cognitive habitus (Nash, 2005; Marjoribanks, 2001, 2006), our measure of academic engagement assesses the extent to which youth perceive themselves to be invested

and integrated into an educational environment; it incorporates self-reported attitudes and performance at Years 2, 3 and 4 (1990, 1991, and 1992). In constructing this measure we drew upon prior research that assessed school engagement using self-report (Connell et al., 1994), parent-report (Brown, 2004) and teacher-report (Anderson et al., 2004), as well as upon evidence of a strong link between school-related attitudes and performance among upper elementary and secondary students (see Eccles, Wigfield, & Schiefele, 1998; Plank & MacIver, 2003).

The *attitude* component of our academic engagement measure included six items: “In general, I like school a lot,” “school bores me,” “I don’t feel like I really belong at school,” “homework is a waste of time,” “grades are very important to me,” and “I try hard at school”. Youth responded to each item using a 5-point scale (*strongly agree* to *strongly disagree*); items were coded such that higher scores indicated higher engagement; the means were 22.9, 22.4, and 21.8, and the internal consistencies were .79, .80, and .80, respectively, at each of the three years. The *performance* component was assessed using youth’s report of own actual school grades, scored on a 12-point scale ($A = 12$, $F = 1$); the means were 9.1, 8.9, and 8.7, respectively across the three years. The internal consistencies based on the complete set of seven standardized items were .79, .80, and .82.

Each component (attitude and performance) was next converted to the same scale so that each contributed equally to the over-all measure of academic engagement. Analyzed separately, the two components correlated with each other .39, .41, and .49 (all $p < .01$) and the internal consistencies of the two components were .55, .57, and .65, respectively, at Years 2, 3, and 4. This construct provides a single comprehensive measure of youth’s self-reported academic engagement for use in evaluating the overall conceptual model.

Educational attainment—We used target youth’s self-report of the number of years of formal education completed by 2002, when these youth averaged 26 years of age. Educational attainment ranged from 10 to 20 years of formal education with a mean of 14.9 years and a standard deviation of 1.92 years. Attainment by this period of the life course should clearly indicate which participants completed high school, completed two to four years of college, or did not pursue post high-school educational training. The data also identify respondents who chose to pursue postgraduate or professional training.

Table 1 reports descriptive statistics (means, standard deviations, skewness, minimum, and maximum) for each variable used in the analyses. We report results for imputed data; these data produce descriptive statistics very similar to the non-imputed data. As previously noted, we use imputed data in order to maximize power and avoid biased findings.

Analytic Approach

To evaluate the conceptual model (Figure 1), we begin by examining the zero-order correlations among the study constructs. We then evaluate direct associations between the three SES variables and educational attainment using *Structural Equation Models* (SEM; Jöreskog & Sörbom, 1993), which allows us to control for the relationships among the SES variables in a test of the most parsimonious model.

In order to evaluate possible linking mechanisms between the SES variables and youth educational attainment, we next use *Latent Growth Curve (LGC) Modeling* to evaluate the conceptual model. Growth curve estimation begins by describing change over time for each individual in the study (Lorenz et al., 1997; Rogosa et al., 1982; Wickrama, Lorenz, & R. D. Conger, 1997; Willett & Sayer, 1994). Conceptually, this is done by fitting a regression line (a growth curve) linking a specific variable to time for each individual in the study. The individual regression prediction equations can then be summarized to obtain an average

intercept and average slope for all individuals, each with a variance. The goal is then to use theoretically-driven covariates to explain why some individuals have higher initial levels (intercepts) than others, and why some have greater rates of change (steeper slopes). Especially important, explanatory covariates also can be growth curve parameters. For example, the level or slope of one variable can be used to predict the level or slope of a second variable as in the present analyses (for details see Wickrama et al., 1997 and Willett & Sayer, 1994). Univariate growth curves for parenting and sibling relations in 1989, 1990 and 1991 and for academic engagement in 1990, 1991 and 1992 were evaluated prior to use in the analytical model.

To evaluate the conceptual model shown in Figure 1, we introduce both sets of mediating variables (family relationships and adolescent academic engagement) as possible channels through which SES characteristics are associated with educational attainment (Paths b-h). All of the linking variables are assessed using growth curves in order to evaluate the family processes (R. D. Conger & K. J. Conger, 2002) and developmental systems (see Lerner, 2002) through which family and individual factors are associated with youth educational attainment.

Results

Correlations among Constructs and Direct Effects of SES on Educational Attainment Zero-order Correlations among Study Constructs

Table 2 presents the zero order correlations among study constructs for the imputed data ($n = 451$), which were used to evaluate the relationship among SES components, the proposed mediating variables, and educational attainment. The results were consistent with our expectations: all three family of origin SES variables were significantly correlated with youths' educational attainment in 2002, ranging from $r = .26, p < .01$ (family per capita income) to $r = .43, p < .01$ (parents' education). Correlations among the three SES variables range from $r = .24 (p < .01)$ for occupational prestige and family per capita income to $r = .56 (p < .01)$ for occupational prestige and parents' education. Other correlations in Table 2 also were consistent with many of the associations predicted in the conceptual model. For example, the level of academic engagement was strongly correlated with later educational attainment ($r = .57$) and with level of supportive parenting was significantly correlated with parents' education ($r = .40$) and the level of academic engagement ($r = .39$). Taken together, the pattern and strengths of the correlations among the study constructs provide a good basis for conducting additional tests related to the theoretical model.

Structural Equation Modeling for the Direct Effects of SES

As the *first step* in our model testing, we used SEM to evaluate the direct association between each of the SES variables and educational attainment, thereby controlling for correlations among the SES variables. In this *initial model*, the associations between educational attainment and parents' education level (standardized path coefficients, $\beta = .31, t = 5.89$), family per capita income ($\beta = .12, t = 2.68$) and occupational prestige ($\beta = .14, t = 2.72$) were all statistically significant and explained 21% of the variance in educational attainment. These results indicate that each separate marker of SES has a unique and additive effect on later educational attainment and are consistent with the current emphasis in the literature that their effects should be considered separately rather than as a combined SES construct (R. D. Conger & Dogan, 2007).

Evaluating Individual Trajectories—Having verified direct relationships between each SES component and educational attainment, we next evaluate the three linking variables proposed in the conceptual model—supportive parenting, positive sibling relations, and academic engagement—using zero order correlations and individual growth curve trajectories.

Growth curves are well-suited to provide insights into the course of individual development over time, with the *initial levels* of variables yielding information about significant variations across individuals at the start (absolute differences) and the *slopes* of variables yielding information about significant variations across individuals in change over time (i.e., cumulative effects; see Lorenz, Wickrama, & R. D. Conger, 2004).

To evaluate the individual trajectories, three univariate growth curves—for supportive parenting, sibling relations, and academic engagement—were estimated by methods of maximum likelihood (Jöreskog & Sörbom, 1993). Covariances were used for these estimates. Table 3 presents the parameters of growth curves using imputed data. All of the univariate growth curves with three consecutive measurements show a good fit with the data as indicated by nonsignificant chi-squares and AGFI = 1.00. These results indicate linear change over time for all study variables. The variances for the intercepts (initial levels) and slopes (rates of change) for the study variables were statistically significant, indicating that there were significant inter-individual differences in initial levels and rates of change over time. The variance for the slope for parenting, however, was only marginally significant across subjects. Two covariances between intercept and slope (i.e., for sibling relations and academic engagement) are significant and negative, which reflects the previously noted ceiling effect.

Evaluating the Conceptual Model

Latent Growth Curve Analyses: Prior to evaluating the complete conceptual model shown in Figure 1, we separately evaluated the effects of the proposed mediating variables on the associations between socioeconomic factors and educational attainment. That is, we first evaluated the mediating role of the parent-child and sibling-sibling interpersonal relationships in relation to the association between SES and educational attainment. We then evaluated the mediating role of adolescent academic engagement on this same relationship. These intermediary models explained 24% and 43% of the variance in educational attainment, respectively. Although support was found for several pathways in these models, no statistically significant direct effects on educational attainment were found for change in supportive parenting or for either the level or change in sibling relations. We next evaluated the complete conceptual model, including hypothesized direct and indirect effects (Figure 2).

The results for the complete model (Figure 2) provide support for several of the hypothesized linking mechanisms from SES through family relationships and academic engagement to educational attainment. The results for the complete model also show a good fit to the data [$X^2_{(52)} = 44.61$] and explains 42% of the variance in educational attainment. As proposed, the direct effect of parents' education on youth educational attainment in the complete model ($\beta = .14$) is reduced by about 50% compared to the initial direct effects model ($\beta = .31$). Parents' education was also positively associated with the level but not the slope for supportive parenting and adolescents' level of academic engagement. Parents' education was not related to positive sibling relations. With the mediating variables in the analysis, the direct association between per capita income and educational attainment declined by about 30%, from .12 to .08. Per capita income also had a direct association with supportive parenting, but not with sibling relations. Occupational prestige did not directly relate to any of the mediating variables and its direct association with educational attainment was essentially unchanged, going from .14 in the direct effects model to .12 in the mediating model.

These results regarding the SES variables suggest that the magnitude of the association of educational attainment with parental education and family income declines when the hypothesized mediating variables are added to the model. This finding is consistent with the idea that the mediating variables do account for some of the connection between these markers of SES and educational attainment. Additional evidence for these mediating pathways is provided in Table 4. For example, the findings in Table 4 demonstrate that parents' education

has a significant direct effect of .14 on educational attainment in the final model plus a significant indirect effect of .19. That is, most of the association between parental education and educational attainment is indirect through supportive parenting, sibling relations and academic engagement. Notice also that parents' education has a statistically indirect effect on sibling relations through supportive parenting and on academic engagement through these relationship variables. Similar but less statistically robust indirect effects also were found for per capita income. As noted, there was no indirect effect of occupational prestige on educational attainment, indicating that none of the proposed mediators accounted for any part of the association between this dimension of SES and later attainment. In general, these standardized coefficients can be interpreted as the change in standard deviation in the outcome variable for each additional standard deviation of the predictor variable after controlling for other predictors.

Furthermore, although the zero-order correlations shown in Table 2 for the initial levels of supportive parenting and sibling relations were directly related with the initial level of academic engagement (i.e., $r = .39$ and $r = .23$, respectively), the parent-adolescent and sibling-adolescent subsystems operate somewhat distinctly in the complete model. The direct effects of the initial level of supportive parenting on level of academic engagement was $\beta = .21$, $t = 3.58$. Change in supportive parenting was directly associated with only change in sibling relations whereas level of supportive parenting was associated with level of positive sibling relations. Initial level of sibling relations is related to initial level of academic engagement ($\beta = .10$, $t = 1.89$). Both the initial level and change in sibling relations are related to change in adolescent academic engagement ($\beta = .16$, $t = 2.24$, $\beta = .25$, $t = 2.65$, respectively). Finally, both the initial level and slope of adolescent academic engagement are directly associated with educational attainment at 26 years of age.

As for the SES variables, several important indirect effects were also found for supportive parenting and sibling relationships, consistent with the conceptual model. The results in Table 4 show that the level of supportive parenting had a significant indirect effect on academic engagement through its association with positive sibling relationships (e.g., the indirect effect for the slope of academic engagement was $.05$, $t = 2.13$). Moreover, the level of supportive parenting also had a significant indirect effect on educational attainment. Similarly, the effects of both the level and slope of supportive sibling relations operated indirectly on educational attainment ($.04$, $t = 2.88$ and $.05$, $t = 2.25$, respectively).

Post-Hoc Analyses: Analyses for differential effects of performance and attitudes: To assess whether results would differ if the academic engagement construct consisted of only the performance component versus only the attitudinal component, post-hoc analyses examined the basic empirical model separately for each component.

Compared with the original complete model, in the re-analysis the path from parenting (level) to academic engagement (level) remained similar when using only performance ($\beta = .23$, $t = 3.93$) but declined in significance when using only attitudes ($\beta = .11$, $t = 1.71$); the association between level and slope of academic engagement was similar when using only performance ($r = -.17$, $t = -2.10$) but stronger when using only attitudes ($r = -.31$, $t = -3.02$). In the re-analysis, the fit indices using only performance or only attitudes were comparable [$X^2_{(52)} = 47.15$, $p = .66$; AGFI = .97; CN = 751.38] and [$X^2_{(52)} = 49.37$, $p = .58$; AGFI = .97; CN = 717.57], respectively. The amount of variance in educational attainment explained was $R^2 = .45$ and $R^2 = .30$, respectively (compared with $R^2 = .42$ for the original model).

Although the magnitude of coefficients of the level and slope differ for performance and attitudes in the re-analysis, all are statistically significant. Of interest is that for performance, initial level is a stronger predictor of educational attainment whereas for attitudes, both level

and slope are moderate predictors of subsequent educational attainment. At each of the three time-points, the bivariate correlation between performance and attitudes are .38, .40, and .49, respectively. This provides evidence that these are two similar but not identical components of academic engagement, and that their correlation increases over time. Taken together these post-hoc results suggest that the linking processes in the empirical model operate similarly whether using academic engagement as measured by only attitudes, only performance, or their composite. Thus, the subsequent post-hoc analyses for this study employed the composite measure of adolescent academic engagement.

Analyses for effects of adolescent gender and age: Post-hoc analyses examined whether the basic empirical model operates similarly for boys and girls or for youth's age relative to the sibling (i.e., older or younger than the sibling). For both sets of Latent Growth Curve (LGC) analyses, we compared the 14 corresponding paths of the models using stacking procedures (Wickrama, R. D. Conger, Lorenz, & Matthews, 1995). Although the mean levels of academic engagement was significantly lower at each of the waves for boys vs. girls (i.e., 1990, 44.31 vs. 46.94, $t = -3.69$; 1991, 43.48 vs. 45.98, $t = -3.50$; 1992, 42.34 vs. 44.71 $t = -3.15$) there were no significant differences in any paths in the LGC models for boys compared to girls. No other statistically significant mean differences by adolescent gender were evident.

In the models comparing results based on youth's age relative to sibling's age (i.e., older versus younger), two of the 14 paths were significantly different. For the relationship between parents' education and academic engagement level, the path for youth who were older than the sibling showed $\beta = .39$, $t = 6.21$; for youth who were younger than the sibling, $\beta = .16$, $t = 2.18$; change in chi-square was 5.04 with 1 degree of freedom. A possible explanation is that parents' education has a larger direct effect on older siblings whereas for younger siblings the effects of parents' education operate through sibling relations. For the association between sibling relations level and academic engagement level, the path for youth with an older sibling showed $\beta = .22$, $t = 2.96$; for youth with a younger sibling, $\beta = .02$, $t = .20$; change in chi-square was 3.86 with 1 degree of freedom. It is possible that target adolescents are more strongly influenced by relations with an older sibling who also would have preceded them in school, than are those with a younger sibling in the study. With the exception of these two paths, none of the other paths produced a statistically significant change in chi-square. Thus, given the small number of statistically significant path differences for model comparisons that examined youth gender and age relative to the sibling, we conclude that the basic model is appropriate for all adolescents, for males and females and for those with younger and older siblings.

Analyses for effects of parent gender: Because we were interested in testing family-level processes with these two-biological-parent families, we did not initially test for differences between the 14 corresponding paths across models for fathers and mothers; we also felt the high collinearity between the father and mother measures precluded using both as separate indicators in the model we tested. In our post-hoc analyses, however, we examined whether the basic empirical model operates similarly using data specific to each parent gender group (i.e., occupation, educational level, and parenting). In models comparing mothers with fathers there was one statistically significant difference: the path between youth educational attainment and parent educational level. The path for models with mothers showed, $\beta = .18$, $t = 4.07$; for models with fathers, $\beta = .08$, $t = 1.78$; change in chi-square was 4.03 with 1 degree of freedom. We performed additional analyses to compare models for fathers of girls and fathers of boys, as well as for mothers of girls and mothers of boys. For fathers, no paths differed significantly by child gender. For comparisons involving the mothers by child gender, the path from sibling relations level to academic engagement level for mothers of girls showed $\beta = .22$, $t = 2.85$; for mother of boys, $\beta = .05$, $t = .69$; change in chi-square was 3.84 with 1 degree of freedom. This finding may be somewhat biased due to the greater attrition of boys than girls over the course of the study. Given the relatively few differences related to parent gender across the three model

comparisons (i.e., 2 of 42 paths), we conclude that the basic model is appropriate for each parent gender and parent-child gender combination.

Effects of sibling gender combinations: A final set of comparisons evaluated models for three types of sibling gender combinations (i.e., brothers pairs, $n = 112$; sister pairs, $n = 131$; and mixed-gender pairs, $n = 208$). None of the path comparisons was significantly different. Thus, we conclude that for these two-biological-parent families, the basic model is appropriate for families with each type of sibling gender combination.

Discussion

This study addressed a gap in the literature regarding the mechanisms by which specific components of SES are related to educational attainment (e.g., see Bornstein & Bradley, 2003; Bradley & Corwyn, 2002). Drawing upon a family investment model (R. D. Conger & Dogan, 2007; R. D. Conger & Donnellan, 2007) to develop the conceptual framework for the present study, our theoretical model specified pathways by which specific family socioeconomic characteristics are associated with youth educational attainment directly and indirectly through family relationships and adolescent academic engagement. We examined the manner in which family and adolescent factors assessed during an initial four year period from early to mid-adolescence are linked to the number of years of education completed by the time of early adulthood—a period that spanned fourteen years. One of the strengths of this research is our use of longitudinal data collected from two generations and multiple sources over a period from early adolescence at age 13 years through early adulthood at 26 years of age. While other researchers have noted the effects of family on children's achievement (e.g., Coleman, 1990), using growth curves to assess these processes allows us to examine both the absolute levels of variables and also individual changes associated with children's achievement (T. Duncan et al., 1999; Willett & Sayer, 1994).

The results indicate a dynamic process that, across time, links both socioeconomic characteristics and family processes to educational attainment, but in somewhat different ways, consistent with a family investment model and with suggestions in recent literature (Bornstein et al., 2003; G. J. Duncan, & Magnuson, 2003; McLoyd, 1998). By including parents' education, family per capita income, and occupational prestige as three separate exogenous variables, we could evaluate the contributions of each SES component. Earlier research by Crosnoe, Mistry, and Elder (2002) found that *economic disadvantage* (a comprehensive scale formed from five items, including parental education and poverty status) assessed seven years earlier significantly predicted youths' enrollment in higher education at age 18-20 years ($b = -.33, p < .01$). In our analyses, which focused on three specific *components of SES*, the total effects on educational attainment of the components were $\beta = .33, p < .001$ (parent education), $\beta = .09, p < .01$ (income), and $\beta = .12, p < .001$ (occupation). Furthermore, we found that the number of years of formal schooling completed by parents was associated with their child's educational attainment both directly and indirectly through supportive parenting; level of education completed by parents was also directly related to adolescent academic engagement. Family per capita income had both a direct and an indirect effect on educational attainment through supportive parenting, whereas parent occupational prestige continued to have only a direct effect. Although parents' education and occupational prestige are collinear, the portion of variance in one that can be explained by the other suggests that the constructs have adequate unique variance to make independent contributions to our model linking socioeconomic characteristics to educational attainment through family interpersonal relationships and adolescent academic engagement.

Furthermore, except for the association between family income and occupational prestige, the correlations among our SES measures are consistent with those for the National Survey of

Families and Households (NSFH). That is, parents' education and family income correlated .34 and .37, parents' education and occupational prestige correlated .56 and .54, and family income and occupational prestige correlated .24 and .37, respectively, for our sample and the NSFH sample (Oakes & Rossi, 2003). Also, in our sample the correlation of each SES component with the initial level of adolescent's academic engagement was .37 (parent education), .22 (income), and .24 (occupational prestige). In White's (1980) meta-analysis the average correlation of each SES component with academic achievement was .19 (education), .32 (income), and .20 (occupation).

In addition, in our sample the effects of family interpersonal relationships on academic engagement followed two pathways, one through the parent-child relationship and the other through the sibling relationship, each illustrating family investment processes. Supportive parenting mainly was directly associated with the initial levels of sibling relations and academic engagement, but not change. In contrast, both the initial level and rate of change in sibling relations were associated with the rate of change in adolescent academic engagement. In other words, although supportive parenting had a strong relationship with adolescent academic engagement during early adolescence, the slight decline in overall level of parental support over time did not have an effect. Conversely, sibling relations started to show a strong and continual association with the academic engagement of their brothers or sisters in the study during this period of time, and poorer relationships improved across time. These results underscore the importance of the parent-child relationship during early adolescence (Scaramella & R. D. Conger, 2004). These results also support other findings that during adolescence, except for peer groups outside the home, similar-aged siblings have increasing influence on adolescents, compared with the influence of parents (e.g., Tucker et al., 2001).

Contrary to our initial expectations, none of the socioeconomic variables had a direct effect on *change across time* in parenting or sibling relations. This suggests that socioeconomic characteristics exert their most powerful effects by setting the process into motion at an earlier time. Additionally, none of the family socioeconomic variables had a direct association with *initial level* of sibling relations. This latter unexpected result highlights the unique effects of sibling relations on adolescent academic engagement and subsequent educational attainment. For example, based on findings by Dunn and associates (1994, 1996) that family SES (assessed by father's occupational status) was associated with sibling relations for middle-school youth, we expected that our SES components would be associated with sibling relations. Zero-order correlations with sibling relations supported this expectation for parent education level ($r = .21, p < .001$) and parent occupation ($r = .12, p < .01$), but not for family income ($r = .07, n.s.$). Our test of the model which simultaneously included the three separate components of SES, however, revealed no statistically significant direct relationships between SES and sibling relations, perhaps due to their influence operating through supportive parenting.

While the mean level of supportive parenting decreased over the three data-collection points—suggesting that as these adolescents became older the extent of praise and affirmation parents were observed to show toward their children declined—change in parenting was not related to change in academic engagement. (See also Scaramella & R. D. Conger, 2004, for a discussion of changes in the parent-child relationship from early to later adolescence.) It was change in sibling relations, however, that was related to change in academic engagement. We found that siblings exerted a strong and continual influence on their brothers or sisters in the study during this period of time; this influence appeared to change with time. As other research has begun to demonstrate, our results provide additional support for the important role of sibling relationships in terms of youth outcomes (G. J. Duncan et al., 2001; Dunn, 1996, 2007). These results are consistent with earlier findings which show that during adolescence similar-aged siblings have increasing influences on adolescents, compared with parents (e.g., Tucker et al., 2001).

In support of the proposed model, academic engagement is related to educational attainment. These results are consistent with findings in a longitudinal study of Australian youth which showed that measures of family background and academic achievement (a proxy for our academic engagement measure), both assessed at age 14 years, had medium associations with educational attainment at age 20 years (Marjoribanks, 2005). In terms of the mechanisms of influence, our results suggest that academic engagement is an important link through which parents and siblings influence educational attainment. Important to our understanding of the effects of parenting on academic outcomes is the *indirect* effect of initial parenting on youth educational attainment through sibling relations and through adolescent academic engagement. From a family investment perspective, this illustrates the contributions of the parent-adolescent subsystem and the adolescent-sibling subsystem, as well as the relationship between these two subsystems, to individual outcomes. The direct effects of siblings on academic engagement are consistent with analyses by Crosnoe and Elder (2004) using the National Longitudinal Study of Adolescent Health which found that non-parental relationships (including sibling relationships) were directly associated with adolescent academic behavior. As previously suggested by Crosnoe, Mistry and Elder (2002), siblings—and in our analyses relations with siblings—may be an important source of social support that promotes engagement in academic pursuits. In general, the multi-faceted processes associated with youth educational attainment we describe here are also consonant with findings in the body of work by Sewell, Hauser, and associates, as well as with recent work on the probability of attending various types of post secondary education using four waves of the National Educational Longitudinal Survey (NELS) by Sandefur, Meier, and Campbell (2006). We extend their work by including family interpersonal processes in our model. Our results highlight the linkages by which educational, economic and interpersonal resources in the family of origin contributes to academic engagement in mid-adolescence and educational attainment at early adulthood. It also is important to note that more than half of the SES effect on educational attainment operates through a measure of supportive parenting that does not measure cognitive stimulation or support for learning.

These results also illustrate the importance of separating the components of SES in research that examines factors associated with educational attainment, as noted by Warren et al. (2002). While occupational prestige had a direct effect on educational attainment by early adulthood, parents' educational attainment and family per capita income had both direct and indirect effects. The lack of indirect effects for the occupational prestige construct may be due to the manner in which the prestige construct was measured (i.e., we used the higher of the parents' occupation) or due to its collinearity with parent education ($r = .56, t = 10.41$). As is usual with occupational prestige measures, the classification system we used to categorize prestige (Nakao & Treas, 1990) relies on income and education typical for a given profession.

Finally, the post-hoc results revealed some interesting trends. The basic processes operated similarly for male and female adolescents, as well as for adolescents with younger versus older siblings. In terms of separately predicting educational attainment from the two components of our academic engagement construct, initial level of performance (measured by grades) was more strongly related to educational attainment than was initial level of attitudes (measured by school liking and engagement). Of interest, however, is that both initial level and change in attitudes are moderately associated with educational attainment. Also, compared with change in performance, change in attitudes was more strongly related to educational attainment. (See Marsh, Trautwein, Lüdke, Köller, & Baumert, 2007, for a discussion showing the effects of academic self-concept on subsequent school grades.) Furthermore, although the general model held across potential structural moderators (i.e., gender, birth order), the slight differences that were revealed are consistent with existing literature. For example, literature supports the significance of sibling relationship experiences for older versus younger siblings (K. J. Conger

et al., 2004; Marjoribanks, 2002) and the stronger link between maternal than paternal education and youth educational attainment (Bornstein et al., 2003).

Limitations

There are several limitations of this study. It is important to note that the associations we found are not necessarily causal and they may contain biases due to omitted variables. For instance, the cognitive ability of students, which is not included in these analyses, was a powerful predictor for school-related outcomes in research by Martens (1984). Likewise, there may be other variables, such as negative peer influences, that could be associated with both sibling relations and academic engagement. Furthermore, because our sample included only youth from households with two biological-parents and at least one near-age sibling, the results may not generalize to households with other family structures, as suggested in research by Brown (2004); on the other hand, the results are noteworthy because the lack of variation in family structure in our sample provides a conservative test of the conceptual model.

We acknowledge that some of the sibling effects on academic engagement and educational attainment may be due to genetic similarities between the two youth, or due to other shared associations (e.g., neighborhood or peer effects), that might influence academic abilities (see Johnson, McGue, & Iacono, 2007; McLoyd, Cauce, Takeuchi, & Wilson, 2000). However, translating genetic similarities into behavioral outcome, and examining other shared associations when predicting sibling effects, both involve complex processes that are beyond the scope of the present report (e.g., Feinberg, Neiderhiser, Howe, & Hetherington, 2001). Nevertheless, the fact that our data came from different reporters serves to support the importance of supportive sibling interpersonal relationship for adolescent academic engagement and subsequent educational attainment.

The model should be tested using participants from other racial groups (McLoyd et al., 2000), especially given some evidence of differential effects of academic engagement for African American and white students (Smerdon, 1999) and of specific socioeconomic factors on child outcomes (Bradley & Corwyn, 2003; McLoyd, 1998; Sirin, 2004). Future research should also consider the potential effects of community and neighborhood on young adult educational attainment (Ainsworth, 2002; Coleman, 1988; McLoyd, 1998). Moreover, we did not examine the impact of fluctuations in income, later family income, or the extent to which family wealth in the form of accumulated assets and net worth affects educational attainment in this sample. In other research net worth has been shown to explain a portion of the racial achievement gap (R. D. Conger & Dogan, 2007; Orr, 2003), which may explain variations within racial groups as well as across racial groups. Furthermore, while we focused on more distal factors associated with educational attainment, it could be informative to examine the effects of more proximal factors such as the young adults' marital and child-rearing situation, access to financial resources, and health status. In addition, more work is needed on understanding conditions under which the expected relationships do not occur; for example, youth who succeed despite socially disadvantaged backgrounds, and vice versa (e.g., see Schoon & Parsons, 2002). Finally, we note that although most young adults will have completed high school and two or four years of college by age 26 years, our cutoff, some young adults have not yet finished their education by this age. Thus, the results might look different if a later assessment was used.

Summary

Despite these limitations, the results of this test of a family investment model detail some of the processes through which family of origin socioeconomic characteristics and interpersonal relationships are linked to educational attainment. Of particular importance are the findings regarding the contributions of supportive sibling relations. We find that: (1) each SES

component—parents' education, per capita family income, and parent occupational prestige—operates in a somewhat unique manner in relation to educational attainment, (2) across adolescence, parents and siblings are associated with different aspects of the adolescent's academic engagement trajectories—parenting is associated with initial level of academic engagement, whereas sibling relations is associated with both initial level and change over time in academic engagement, (3) supportive parenting has a direct effect on sibling relations, (4) adolescent academic engagement is a key variable that links supportive parenting and sibling relations to educational attainment, (5) both the initial level of and change in academic engagement are related to educational attainment by the time of early adulthood, and (6) post-hoc results illustrate both initial attitudes and initial performance predict educational attainment; however, it is change in attitudes, not change in performance, that is associated with educational attainment.

In addition to increasing understanding of processes by which the family investment model operates in regard to educational attainment in early adulthood, these results have several practical implications. Because the effects of supportive parenting are relatively stable across adolescence, and because supportive parenting is associated with both the level and rate of change in the sibling relationship, establishing supportive parenting relationships during early adolescence is of key importance. Siblings have an initial and continuing effect on academic engagement during adolescence, so it would be useful to identify positive ways to enhance sibling relationships throughout adolescence (e.g., Kramer, 2004). Given the strong association between academic engagement and educational attainment, parents and educators also should identify ways to promote academic engagement. This could take the form of encouraging participation in academic clubs and extracurricular activities, as well as promoting good study skills. Future research should examine additional family and individual characteristics associated with later educational attainment. Furthermore, given the potential link between early family and individual characteristics and youths' educational attainment and later occupational success (e.g., Dubow, Huesmann, Boxer, Pulkkinen, & Kokko, 2006; Schoon et al., 2002), future research should extend these analyses to look at processes by which the family investment model operates in regard to occupational attainment.

Acknowledgments

This research was supported in part by grants from the National Institute of Child Health and Human Development, the National Institute on Drug Abuse, and the National Institute of Mental Health (HD047573, HD051746, and MH051361). Support for earlier years of the study also came from multiple sources, including the National Institute of Mental Health (MH00567, MH19734, MH43270, MH59355, MH62989, and MH48165), the National Institute on Drug Abuse (DA05347), the National Institute of Child Health and Human Development (HD027724), the Bureau of Maternal and Child Health (MCJ-109572), and the MacArthur Foundation Research Network on Successful Adolescent Development Among Youth in High-Risk Settings.

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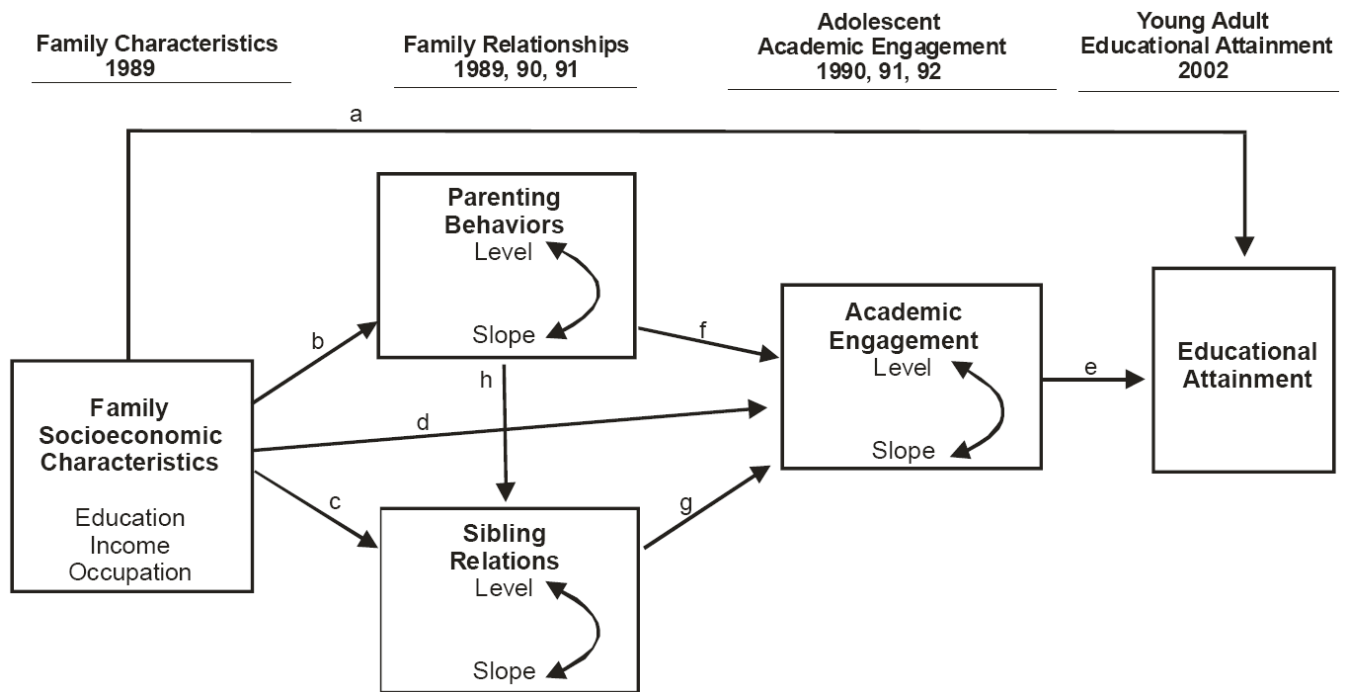


Figure 1. Proposed model for the influence of family interpersonal relationships and adolescent academic engagement on linkages between family socioeconomic characteristics and educational attainment in early adulthood.

7th Grade (age 13) 7th - 9th Grade (ages 13-15) 8th - 10th Grade (ages 14-16) Young Adulthood (age 26)

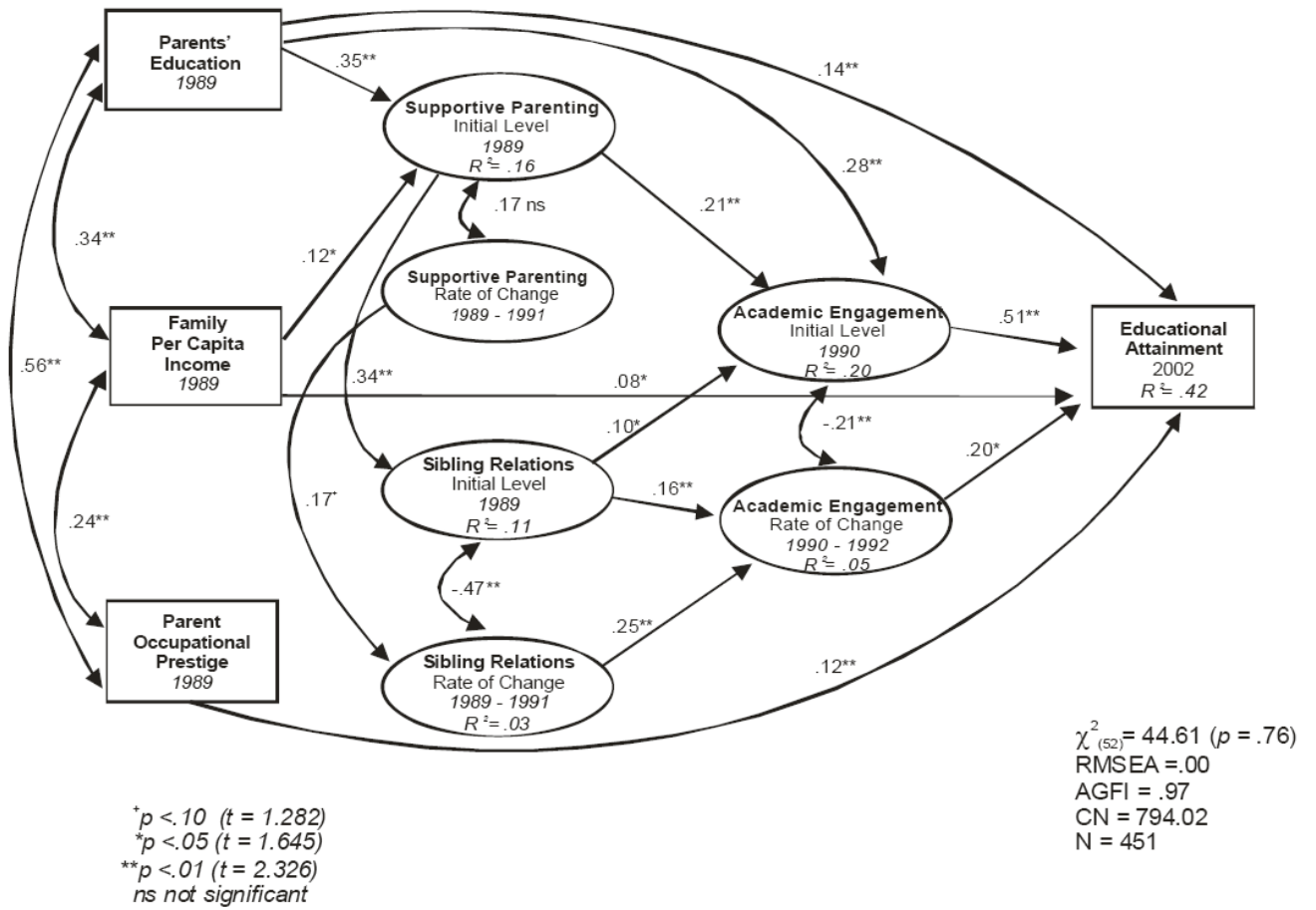


Figure 2. The effects of family interpersonal relationships and adolescent academic engagement on linkages between family socioeconomic characteristics and educational attainment in early adulthood.

Table 1
Means, standard deviation, skewness, minimum, and maximum for imputed date (n = 451).

Variable	Mean	Standard Deviation	Skewness	Minimum	Maximum
Parents' education					
1989	13.38	1.62	.70	8.50	19.00
Family per capita income					
1989	11.38	.06	2.16	11.15	11.79
Occupational prestige					
1989	47.37	11.99	.35	22.05	86.05
Supportive parenting					
1989	5.97	.91	-.07	3.27	8.45
1990	5.56	.99	-.25	2.09	8.45
1991	5.20	.93	-.36	2.27	7.73
Sibling relations					
1989	2.73	.47	-.21	1.26	3.91
1990	2.78	.48	-.09	1.30	4.00
1991	2.83	.47	-.33	1.39	3.91
Academic engagement					
1990	45.69	7.59	-.55	17.00	60
1991	44.78	7.68	-.47	12.00	60
1992	43.58	8.04	-.37	17.50	60
Educational attainment					
2002	14.87	1.92	.15	10.00	20.00

NOTE. Results were nearly identical for raw and imputed parameters.

Table 2

Zero-Order Correlations among Constructs (n = 451)

	Parents' education	Family per capita income	Occupational prestige	Supportive parenting (Level)	Supportive parenting (Slope)	Sibling relations (Level)	Sibling relations (Slope)	Academic engagement (Level)	Academic engagement (Slope)	Educational attainment
Parents' education	1.00									
Family per capita income	.34***	1.00								
Occupational prestige	.56***	.24***	1.00							
Supportive parenting (Level)	.40***	.25***	.29***	1.00						
(Slope)	-.05	-.07	-.10	.33	1.00					
Sibling relations (Level)	.21***	.07	.12**	.37***	-.02	1.00				
(Slope)	-.10*	-.01	-.05	-.03	.29*	-.48***	1.00			
Academic engagement (Level)	.37***	.22***	.24***	.39***	-.02	.23***	-.07	1.00		
(Slope)	.05	-.01	.03	-.01	.14	.04	.18*	-.16 ⁺	1.00	
Educational attainment	.43***	.26***	.34***	.33***	.11	.15***	.02	.57***	.12*	1.00

+ $p < .10$ if $1.64 < t < 1.96$;* $p < .05$ if $1.96 < t < 2.32$;** $p < .01$ if $2.32 < t < 2.58$;*** $p < .001$ if $t > 2.58$ (two-tailed).

Table 3
 Estimates for univariate growth curves for supportive parenting, sibling relations, and academic engagement (unstandardized coefficients)
 (n = 451).

	Initial Level		Rate of Change		Covariance		χ^2 (df)	AGFI
	Mean	Variance	Mean	Variance	π_{0i} & π_{1i}	Variance		
Supportive parenting (observer report)	5.96	.45 ^{***}	-.39 ^{***}	.06 ⁺	.01		.64 ₍₁₎ (<i>p</i> = .42)	1.00
Sibling relations (sibling report)	2.73	.19 ^{***}	.05 ^{***}	.02 ^{***}	-.03 ^{***}		.004 ₍₁₎ (<i>p</i> = .95)	1.00
Academic engagement (target report)	45.74	48.80 ^{***}	-1.07 ^{***}	4.84 ^{***}	-2.03 ^{***}		.83 ₍₁₎ (<i>p</i> = .36)	1.00

⁺ *p* < .10 (two-tailed).

^{*} *p* < .05 (two-tailed).

^{**} *p* < .01 (two-tailed).

^{***} *p* < .001 (two-tailed).

Table 4

Decomposition of effects for Latent Variables Structural Equation Model of variables associated with educational attainment in early adulthood (t-values listed in parentheses.)

Predictor	Dependent Variable	Total Effect	Direct Effect	Indirect Effect
Parents' education	Supportive parenting (L)	.35 (6.21)	.35 (6.21)	
	Sibling relations (L)	.12 (4.64)		.12 (4.64)
	Academic engagement (L)	.37 (8.28)	.28 (5.83)	.09 (3.58)
	Academic engagement (S)	.02 (2.02)		.02 (2.02)
	Educational attainment	.33 (6.53)	.14 (2.86)	.19 (6.93)
Family per capita income	Supportive parenting (L)	.12 (2.11)	.12 (2.11)	
	Sibling relations (L)	.04 (2.02)		.04 (2.02)
	Academic engagement (L)	.03 (1.91)		.03 (1.91)
	Academic engagement (S)	.01 (1.50)		.01 (1.50)
	Educational attainment	.09 (2.36)	.08 (1.99)	.02 (1.92)
Occupational prestige	Educational attainment	.12 (2.73)	.12 (2.73)	
Supportive parenting (L)	Sibling relations (L)	.34 (6.64)	.34 (6.64)	
	Academic engagement (L)	.25 (4.37)	.21 (4.37)	.04 (1.85)
	Academic engagement (S)	.05 (2.13)		.05 (2.13)
	Educational attainment	.14 (4.44)		.14 (4.44)
Supportive parenting (S)	Sibling relations (S)	.17 (1.57)	.17 (1.57)	
	Academic engagement (S)	.04 (1.35)		.04 (1.35)
	Educational attainment	.01 (1.29)		.01 (1.29)
Sibling relations (L)	Academic engagement (L)	.10 (1.89)	.10 (1.89)	
	Academic engagement (S)	.16 (2.24)	.16 (2.24)	
	Educational attainment	.08 (2.88)		.08 (2.88)
Sibling relations (S)	Academic engagement (S)	.25 (2.65)	.25 (2.65)	
	Educational attainment	.05 (2.25)		.05 (2.25)
Academic engagement (L)	Educational attainment	.51 (12.12)	.51 (12.12)	
Academic engagement (S)	Educational attainment	.20 (4.27)	.20 (4.27)	
Fit indices	R-square	.42		
	Chi-square	44.61		
	<i>df</i>	52		
	<i>p</i>	.76		

Predictor	Dependent Variable	Total Effect	Direct Effect	Indirect Effect
	AGFI	.97		
	CN	794.02		
	RMSEA	0.0		