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**Sibling Relationship Predictors of Academic Achievement in Adolescents**

by

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Committee in charge:

Professor Susan Holloway, Chair

Professor Frank Worrell

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## Abstract

## Sibling Relationship Predictors of Academic Achievement in Adolescents

by

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Doctor of Philosophy in Education

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During adolescence older siblings who are close in age may serve as examples to emulate or become different from. Key features of the sibling relationship that may promote similar sibling outcomes include sibling intimacy, older sibling support, younger sibling image of the older sibling, and self-reported social learning and differentiation. The goal of this dissertation was first to (a) examine whether older sibling support represents a single or multiple factors and then to (b) investigate which aspects of the sibling relationship predict younger siblings' membership in one of four achievement groups.

Data was collected from 288 younger siblings (YS) in ninth and tenth grade. Participants reported their own and their older sibling's (OS) grades and completed measures of sibling intimacy, OS support for YS academic plans, YS image of OS, social learning, and differentiation. They also completed demographic and family data including family cohesion and parent expectations of achievement. First, factor analysis results indicated that OS support for YS academic plans represented four distinct factors: Encouragement, Goal Setting, OS Academic Engagement, and Involvement. Second, four sibling achievement groups were created based on a median split of grades in order to determine which of these factors as well as other sibling relationship variables best predicted younger siblings' achievement in the context of their older sibling's achievement: OS high-YS high (HH), OS high-YS low (HL), OS low-YS high (LH), and OS low-YS low (LL). Discriminant analyses indicated that younger siblings were most often correctly classified (55% correct) into their corresponding achievement group when GPA rather than a global rating of grades was used as a measure of academic achievement. The strongest predictor of YS achievement was OS academic engagement, followed by parent expectations of achievement and differentiation. Classification was most accurate (81%) when older siblings were high achievers and when parent expectations of achievement were not low and most inaccurate (37-46%) when older siblings were low achievers.

These results provide evidence that older siblings' academic engagement is a key aspect of older sibling support that relates to younger siblings' academic achievement and highlight the importance of both sibling and family variables in influencing younger siblings' achievement. Given that the sibling relationship is both nested within a family and has distinct influences, future research should use a multilevel approach with data from multiple informants in order to distinguish between family, parent, and sibling influences and examine the relative contributions of each of these relationships.

## **Dedication**

To my Creator, in whom I live and move and have my being

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And lastly, thank you Jesus, my Savior, for changing my life and giving me a new perspective. Because of you I wake up to a different world. Everything I do, I do it for you.

## **Sibling Relationship Predictors of Academic Achievement in Adolescents**

High academic achievement is an outcome of interest to both researchers and professionals within the field of education and is generally an outcome desired by many parents and youth. An important question that is raised by educators, parents, and often society at large is how we can promote high academic achievement in students and what factors or contexts have an influence on academic achievement throughout a child's development. Bronfenbrenner (1986) highlighted that there are several micro and macro contexts that have an impact on child development, and one context that has been studied extensively in terms of its impact on academic achievement is the family. Several studies have investigated the importance of parents on children's academic achievement (e.g., Bean, Bush, McKenry, & Wilson, 2003; Masten, Juvonen, & Spatzier, 2009; Wong, 2008), but surprisingly, the influence of siblings, who are an integral part of the family, has been relatively understudied.

The vast majority of children live with at least one sibling (U.S. Bureau of the Census, 2011), and the proximity and frequency of contact between an older and younger sibling can create many opportunities for sibling influence. In particular, during adolescence, older siblings who are close in age may serve as examples for their younger siblings to emulate or become different from. Several research findings have confirmed that this is often the case. In fact, younger siblings' behavior tends to resemble the behavior of their older siblings across many domains, from delinquency (Craine, Tanaka, Nishina, & Conger, 2009), risky sexual behavior (McHale, Bissel, & Kim, 2009), and substance use (Fagan & Najman, 2005) to social competence (Kim, McHale, Crouter, & Osgood, 2007). There is also some evidence that the academic achievement of siblings tends to be similar (Widmer & Weiss, 2000) and that adolescents perceive academics as a domain in which they are generally similar to their siblings (Watzlawik, 2009).

Despite similarities in the behaviors and academic achievement of some sibling pairs, not all siblings have similar outcomes. It is possible that there are particular processes that operate in sibling relationships to either promote or discourage sibling similarities, and recent research has used a social learning framework to highlight some features of sibling relationships that might lead younger siblings to have more similar outcomes to their older siblings (e.g., Whiteman, Becerra, & Killoren, 2009). However, with regards to academic achievement during adolescence, it remains unclear which of these features are relevant and how they are related to similar achievement between siblings. For example, Milevsky and Levitt (2005) found that receiving support from brothers was associated with higher academic achievement for adolescent boys but not girls, but Bouchev and colleagues (2010) found that receiving support from an older sibling predicted a decline in adolescents' academic achievement.

Academic achievement during adolescence can have important implications for educational and professional opportunities, from establishing eligibility for college preparatory classes to limiting access to post-secondary education and employment opportunities, and older siblings can play a role in motivating or discouraging academic achievement in their younger siblings. Accordingly, this dissertation drew from and expanded on previous research by examining which features of the sibling relationship predict younger siblings' academic achievement.

This dissertation had two aims. Given that there are mixed findings regarding the relationship between sibling support and younger sibling academic achievement (e.g., Bouchev

et al., 2010; Milevsky & Levitt, 2005), the first aim was to examine whether sibling support represents a single construct or multiple dimensions that are distinct from each other. To that end, an exploratory factor analysis was conducted on a scale of older sibling support for younger sibling academic plans. The scale included items measuring different types of support (e.g., encouragement, involvement, instrumental support) within the academic domain.

The second aim was to investigate which features of the sibling relationship best predicted the academic achievement of the younger siblings in the context of the older siblings' academic achievement. Several features of the sibling relationship were measured given previous research highlighting the importance of these variables for adolescents' academic outcomes: sibling intimacy, older sibling support for younger sibling academic plans, younger sibling image of older sibling, and older sibling influence. Sibling intimacy refers to emotional closeness between siblings. Older sibling support for younger sibling academic plans involves several types of support relevant to younger siblings' academic achievement (e.g., giving praise for high academic achievement, helping with homework). Younger sibling image of older sibling refers to the image a younger sibling has of their older sibling, both in general and specifically with regards to academics. Lastly, older sibling influence measures younger siblings' perception of how their older sibling influences them and whether they try to be similar to or different from their older sibling. Younger siblings were placed in four achievement groups based on their own and their older sibling's academic achievement, and features of the sibling relationship were analyzed through multivariate analyses of variance and follow-up discriminant analyses in order to determine which of these features best predicted younger siblings' membership in the academic achievement groups.

### **Sibling Similarities in Academic Outcomes**

Sibling similarities and differences are a fascinating topic that has drawn the attention of researchers as well as the general public. The general observations tend to focus on how different siblings are despite coming from the same family and having relatively equal parental influences (e.g., Dunn & Plomin, 1991; Schachter, Shore, Feldman-Rotman, Marquis, & Campbell, 1976; Sulloway, 1996). However, some researchers have also highlighted that siblings' outcomes in domains such as academic achievement can be positively correlated (e.g., Feinberg & Hetherington, 2000; Whiteman et al., 2009).

A handful of studies have examined correlations between siblings' academic outcomes. As noted by Lewin, Hops, Davis, and Dishion (1993), earlier studies of siblings' behaviors were problematic because they typically consisted of observing siblings interact with each other, which confounded the direct influence that siblings could have on each other's behavior during that interaction. Accordingly, Lewin and colleagues sought to measure siblings' behaviors independently of each other. They obtained teacher ratings in several domains, including mathematics competence, reading competence, and school adjustment, for 45 sibling pairs in Grades 2 to 5. These ratings were then combined into a broader "academic skills" category, and correlations were computed for the individual ratings as well as the academic skills category. Results indicated large correlations across both individual ratings of academic competence and the broader category of academic skills ( $r = .60 - .65$ ). Furthermore, the academic skills of the older sibling explained 51% of the variance in the academic skills of the younger sibling. Although this study included school-age children rather than adolescents, it made a significant

contribution to the field by revealing that siblings had significant similarities in academic outcomes even when outcomes are measured independently for each sibling.

Widmer and Weiss (2000) extended the findings of Lewin and colleagues (1993) by focusing on 148 adolescent sibling dyads ( $M_{\text{age}} = 15.3$  and 12.1 years for older and younger siblings, respectively). School success was measured with various items (e.g., number of Ds and Fs, being held back a grade, taking an advanced class), and school engagement was measured in terms of feelings of involvement with school (e.g., liking school, thinking that grades are important). Results indicated that there was a small but significant correlation between older and younger siblings' school success ( $r = .21$ ) but not between their school engagement. It is notable that this correlation was weaker than those found by Lewis and colleagues (1993), possibly due to the additional factors that may play a role in adolescents' academic outcomes that are not as influential in younger children (e.g., extracurricular activities, peer influence, more challenging material).

Several theories have been proposed to explain why siblings' academic achievement is positively correlated, including behavior genetics (e.g., Feinberg & Hetherington, 2000) and shared parenting (e.g., Lewin et al., 1993). However, a major problem of these theories is that they do not specify the processes that underlie sibling similarities, and, as a result, many studies that have used these theories have only applied them post hoc to explain sibling similarities. One theory that does propose specific processes that may lead to similarities is social learning theory, or modeling (Bandura, 1969). This theory has been applied post hoc to explain some sibling similarities (e.g., McHale et al., 2009), but recent work by Whiteman and colleagues (2007a, 2007b, 2008, 2010) attempted to measure these processes directly and relate them to sibling similarities by examining how younger siblings' report of modeling influences was related to actual similarities between younger and older sibling outcomes. As reviewed below, two of these studies related modeling influences to similarities in siblings' academic outcomes.

In their first study, Whiteman, McHale, and Crouter (2007a) asked younger siblings ( $M_{\text{age}} = 13.78$  years) from 171 families to rate how often they tried to be like or different from their older sibling and how often they competed with their sibling in several domains. Cluster analysis was used to form three groups based on the patterns of responses: a differentiation group (high on trying to be different from and low on both trying to be like and competing with the sibling), a modeling group (high on both trying to be like and competing with the sibling, average on trying to be different from the sibling), and a non-referent group (low on all three ratings). School grades were obtained from both older and younger siblings, and correlations between siblings' grades on language arts, mathematics, science, and social studies were computed separately for each group. Significant small to moderate correlations were found in both the modeling and non-referent groups ( $r = .18 - .36$ ), suggesting that there is a moderate degree of similarity in school grades for at least some adolescent sibling dyads.

In a later study, Whiteman, Bernard, and McHale (2010) extended these findings to African-American siblings. The authors noted that African-American populations tend to have more siblings per family and emphasize a caregiving role for older siblings, so they suggested that sibling influence might be stronger in African-American dyads. A total of 166 African-American younger siblings ( $M_{\text{age}} = 12.59$  years) completed a sibling influence measure that provided two subscale scores based on whether the sibling reported trying to be different from or similar to their older sibling (differentiation and social learning scores, respectively). Scores for school bonding (e.g., how close students felt to others at their school) and commitment to

learning (e.g., how eager students were to do well in school) were obtained from both siblings, and difference scores for these outcomes were calculated for each sibling dyad. Partial correlations were then computed separately between these difference scores and each of the sibling influence subscale scores (i.e., differentiation and social learning). Results indicated small negative correlations of social learning scores on school bonding and commitment to learning difference scores ( $r = -.23$  to  $-.14$ ). In other words, younger siblings' reports of trying to be like their older sibling were associated with smaller differences between the school bonding and commitment to learning behaviors of themselves and their older sibling.

Taken together, these studies provide evidence for a small to moderate degree of similarity between adolescent siblings' academic outcomes and behaviors. The work of Lewin and colleagues (1993) and Widmer and Weiss (2000) indicated that siblings do tend to have significant similarities in academic outcomes, and the work of Whiteman and colleagues (2007a, 2010) provided further insight into the social learning processes that underlie such similarities. Moreover, Whiteman and colleagues' work highlighted the utility of social learning theory for examining the mechanisms of sibling influence. This theory as well as the specific mechanisms of influence that it proposes are described below.

### **Social Learning Mechanisms of Sibling Influence**

Social learning theory (Bandura, 1969) is an earlier version of social cognitive theory (e.g., Bandura, 1986). Although social cognitive theory has undergone several revisions and expansions, increasingly placing an emphasis on human agency (e.g., Bandura, 2001), it is the earlier ideas of social learning theory that have been applied to sibling research (e.g., Whiteman et al., 2007a, 2010). In order to be consistent with the terminology used in this field, I will use the terms *social learning* and *modeling* interchangeably as opposed to *social cognitive*.

Social learning theory posits that individuals may learn certain behaviors by observing other individuals perform those behaviors. Many researchers have used social learning processes as a post hoc explanation of why siblings may share similarities in areas such as academic achievement, psychological adjustment, and risky behavior (e.g., Bouchey et al., 2010; Craine et al., 2009; Kim et al., 2007), and other researchers have directly examined the relationship between self-reported sibling influence and similar behavioral outcomes (e.g., Whiteman & Christiansen, 2008; Whiteman et al., 2010). Presumably, younger siblings view older siblings as role models with whom they can identify, leading to similar behaviors and outcomes. Bandura (1969) identified four important variables that influence whether or not a behavior will be imitated: nurturance, vicarious reinforcement, status, and similarity. These variables have been examined to various degrees in the context of sibling relationships, as reviewed below.

**Nurturance.** According to social learning theory, individuals are more likely to identify with and model their behavior after someone who is nurturing and warm (Bandura, 1969). This is both because a warm model tends to spend more time with an individual, increasing exposure to behaviors that may be modeled, and because the model's nurturance and warmth towards the imitator likely increases as the model's behaviors are imitated and this increase in warmth acts as a reward for the imitator. Accordingly, a sibling who is more nurturing is more likely to become a model than a sibling who is less nurturing. Sibling researchers have examined sibling nurturance in terms of a warm and intimate relationship, support, and time spent together.

**Warmth and intimacy.** In sibling influence research, nurturance has most often been measured in terms of a positive, intimate, and warm sibling relationship. The evidence for the link between intimacy and warmth and similarity between siblings is strong. Feinberg and Hetherington (2000) used data from 720 same-gender sibling dyads ( $M_{\text{age}} = 14.5$  and  $12.9$  for older and younger siblings, respectively) and compared sibling positivity (e.g., closeness, adaptive problem-solving, empathy) and negativity (e.g., aggressiveness, rivalry, coercion) to correlations between siblings' psychosocial adjustment. Siblings completed several self-report measures of psychosocial adjustment (e.g., depressive symptoms, sociability, autonomy, self-worth) and answered questions about the positivity and negativity in their relationship. Results indicated a pattern where siblings high in positivity had a higher correlation on each measure of psychosocial adjustment than siblings low in positivity ( $r = .12 - .68$  versus  $.07 - .55$ , respectively), consistent with social learning theory.

As briefly discussed earlier, Whiteman and colleagues (2007a, 2007b; Whiteman & Christiansen, 2008) used a social learning framework to examine the relationship between reports of sibling influence and similarities in siblings' outcomes. They published a series of three papers from the same longitudinal study where they obtained data from 191 primarily White, middle-class families. Participants were firstborn and secondborn siblings ( $M_{\text{age}} = 16.39$  for firstborns and  $13.78$  for secondborns during Year 6), and data for the papers was collected during Years 6 and 7 of the longitudinal study. Several aspects of the sibling relationship were measured. First, both siblings in each dyad reported how much time they spent on various activities and how much time they spent with their sibling. They also completed self-report measures of sibling intimacy, socio-emotional functioning, and risky behavior. Measures of sibling influence varied across each analysis and included (a) secondborns' ratings of how often they tried to be like or different from their sibling and how often they competed with their sibling in sports, the arts, school, and conduct behaviors (Whiteman et al., 2007a), (b) secondborns' ratings of the degree to which their sibling sets an example for them and includes them in activities (Whiteman et al., 2007b), and (c) firstborns' and secondborns' answers to open-ended questions about their sibling's influence on them (Whiteman & Christiansen, 2008).

Groups of siblings were identified using several different techniques. Whiteman and colleagues (2007b) measured only social learning processes based on sum scores of a sibling influence scale. Whiteman and colleagues (2007a), as reviewed earlier, used cluster analysis and found three patterns of sibling influence: modeling, differentiation, and non-referent. Finally, Whiteman and Christiansen (2008) identified four patterns based on siblings' perceptions of influence: modeling, differentiation, both modeling and differentiation, and no influence. With regards to sibling intimacy, findings were consistent across these different analyses. Sibling intimacy was strongly correlated with reports of social learning ( $r = .62$ ; Whiteman et al., 2007b), and in the analyses that included sibling influence groups, sibling intimacy was higher in the modeling group relative to other groups (Whiteman et al., 2007a; Whiteman & Christiansen, 2008). This effect was strongest when comparing the modeling group to either the differentiation group or the both modeling and differentiation group ( $d = .48 - .54$ ).

These sibling influence findings were replicated in a study of 166 African American families (Whiteman et al., 2010). Two consecutive-born children from each family ( $M_{\text{age}} = 16.29$  and  $12.59$  for older and younger siblings, respectively) reported how much time they spent together with their sibling. They also completed self-report measures of sibling positivity and negativity, risky behaviors, attitude towards academics, attitude towards substance use, and

social competence. As mentioned earlier, younger siblings also completed an 18-item measure of sibling influence. Factor analysis was used to assign items to either a social learning or a differentiation subscale. Consistent with social learning theory and with the previous analyses of Whiteman and colleagues (2007a, 2007b; Whiteman & Christiansen, 2008), results indicated that social learning scores were positively correlated with sibling positivity ( $B = .52$ ) and negatively correlated ( $B = -.42$ ) with sibling negativity.

Taken together, these studies show a consistent pattern where siblings who have a more intimate or positive relationship have more similar levels of psychosocial adjustment (Feinberg & Hetherington, 2000) and report greater sibling modeling influence (Whiteman et al., 2007a, 2007b, 2010; Whiteman & Christiansen, 2010).

***Social and domain-specific support.*** Most measures of sibling intimacy and warmth typically include some items on sibling support (e.g., “How much do you go to your brother/sister for advice/support?”; Whiteman et al., 2007a, p. 648) that measured either social support or domain-specific support (e.g., academic support). However, in many of these studies researchers do not distinguish between sibling intimacy and sibling support, and thus it is not known if sibling support is related to social learning processes independent of sibling intimacy.

Nevertheless, there is evidence from other studies that domain-specific sibling support may be a different construct than sibling warmth and intimacy. For example, as reviewed earlier, Alfaro and Umaña-Taylor (2010) gathered data from 258 Latino adolescents and found that the relationship between perceived academic support from siblings, sibling warmth, and academic motivation was moderated by gender. For girls, sibling warmth predicted academic support from siblings, and support from siblings predicted academic motivation only in the context of a warm sibling relationship. For boys, sibling warmth predicted academic support from siblings, which in turn predicted academic motivation, but there was no direct relationship between sibling warmth and academic motivation. Given the different role of sibling warmth and academic support from siblings in this study, it is possible that support and warmth, or intimacy, are separate constructs. However, this study does not provide strong support for this hypothesis given that sibling intimacy and support were measured as based on all siblings rather than on specific sibling dyads.

Studies that have measured support from a single sibling within a specific sibling dyad have yielded mixed findings regarding the influence of older sibling support on younger siblings’ academic outcomes. For example, Milevsky and Levitt (2005) found that the influence of older sibling support was moderated by gender, such that receiving support from older brothers was associated with higher academic achievement for boys but not girls. In contrast, Bouchey and colleagues (2010) did not find a moderating effect of gender and instead found a main negative effect of support from older siblings on younger siblings’ academic achievement. These studies highlight the need for more research on the role of older sibling support on younger siblings’ academic outcomes.

One possible explanation for the mixed findings on sibling support is that sibling support may reflect distinct dimensions that have a differential effect on younger siblings’ outcomes. In fact, social support has been theorized to have four dimensions that may have different antecedents and consequences: emotional concern, instrumental aid, information about the environment, and appraisal about the self (Dunkel-Schetter, Folkman, & Lazarus, 1987). Malecki and Demaray (2003) investigated whether these different types of social support from parents, teachers, classmates, and close friends had a differential impact on the academic

outcome of 263 students in Grades 5 through 8. The four types of support were measured via the Child and Adolescent Social Support Scale: emotional (e.g., “My parents understand me”), informational (e.g., “My classmates give me ideas when I don’t know what to do”), appraisal (e.g., “My close friend nicely tells me the truth about how I do on things”), and instrumental support (e.g., “My teacher spends time with me when I need help”). Results indicated that emotional support from teachers predicted students’ academic competence, but that there was no differential influence of the types of support from parents, classmates, and close friends on students’ academic outcomes. Although support from older siblings was not measured in this study, this study raises the possibility that different aspects of support from certain individuals may have differential effects on student outcomes.

Whereas the above study used a theoretical approach to define four different types of support, Ali, Martens, Button, and Larma (2011) directly examined whether support from siblings represented a single or multiple dimensions by conducting a factor analysis on a scale of support for postsecondary plans (e.g., going to college, getting a job). A total of 316 high school students completed several scales of support from different individuals (e.g., mother, father, sibling, community), and several aspects of support were measured including encouragement, involvement, and providing knowledge about available resources. Their results were contrary to their hypothesis and revealed only one factor of support for each scale. This is striking given that Malecki and Demaray’s (2003) study indicated differential effects on several aspects of teacher support on students’ academic outcomes. However, there are methodological differences between these two studies that make it difficult to make generalizations based on their findings. For example, Malecki and Demaray (2003) assumed that the four types of support were distinct based on theory, did not examine support from siblings, and used academic achievement as an outcome, while Ali and colleagues (2011) conducted a factor analysis to directly test whether distinct dimensions of social support emerged, obtained data on support from older siblings, and focused on support for postsecondary plans rather than academic achievement.

Altogether, the mixed findings regarding the role of sibling support on academic achievement and whether or not there are distinct types of support for academic achievement raise the need for further research in this area to clarify these issues.

**Temporal involvement.** One of the tenets of social learning theory is that nurturance leads to modeling because a more nurturing model is presumed to spend more time with an individual, that is, there is a greater degree of *temporal involvement* between them. In the context of sibling relationships, siblings who have a warmer and more intimate relationship are presumably motivated to spend more time together, and consequently their time spent together in shared activities may provide more opportunities for social learning. Very few studies have examined the role of siblings’ temporal involvement on sibling influence, but those that have yielded mixed findings. In one analysis of the data from their longitudinal study, Whiteman and colleagues (2007b) found that temporal involvement was positively correlated with reports of social learning ( $r = .30$ ), but in another analysis (2007a), they found no difference in temporal involvement between siblings in the modeling group and siblings in the differentiation group. This null finding was also reported by Whiteman and colleagues (2010). It is possible that temporal involvement may yield significant effects on modeling when measured over a particular time period (e.g., over the course of weeks or months rather than days) or that temporal involvement may be correlated with modeling within a given group but

that there may not be group differences in temporal involvement. Hence, more research is needed to clarify the role of temporal involvement in sibling influence processes.

Overall, findings regarding nurturance are consistent with social learning theory and show that adolescents who are warm towards their siblings and have an intimate sibling relationship are more likely to influence their siblings across various domains. However, findings on the role of sibling support and temporal involvement highlight the complexity of sibling relationships and need further clarification with regards to how they affect sibling influence processes.

**Vicarious reinforcement and power status.** Another aspect of social learning is vicarious reinforcement, where individuals are more likely to model behaviors that have been vicariously reinforced through their model (Bandura, 1969). In other words, when an individual observes a model being reinforced for a particular behavior, that individual is more likely to perform that behavior. This can occur with both positive and negative behaviors. For example, in the context of sibling relationships, siblings may be more likely to be aggressive when their siblings successfully use aggression to get their way, but they may also be more likely to study hard if their sibling's diligent study habits are praised by their parents. Similarly, a model's status, whether defined as popularity, prestige, or success, may itself be a vicarious reinforcement. Thus, according to social learning theory individuals are also more likely to imitate models who have a high status, presumably because they hope that imitating the behavior of that model will lead to equally favorable outcomes.

**Birth order.** Sibling influence researchers have examined vicarious reinforcement only in terms of status. Older siblings have a high status due to their birth order, and there is substantial evidence that older siblings have a greater influence on younger siblings than vice versa. As previously discussed, Whiteman and Christiansen (2008) asked firstborn and secondborn siblings how they were influenced by their sibling and formed four groups of influence based on responses: modeling only, differentiation only, both modeling and differentiation, and no influence. Results showed that the majority of firstborns were in the no influence group whereas only a minority of secondborns were in the no influence group (59% versus 36%, respectively). In addition, Tucker, Updegraff, and Baril (2010) conducted a 3-year longitudinal study of patterns of control in adolescent sibling dyads ( $M_{\text{age}} = 14.94$  and  $12.43$  for firstborns and secondborns, respectively). They found that the majority of dyads (67%) reported a firstborn-dominant pattern of control as opposed to an equal (22%) or second-born-dominant (11%) pattern, and that this pattern was consistent across three years.

Finally, Wong and colleagues (2010) conducted a study of 498 Dutch sibling dyads ( $M_{\text{age}} = 16.78$  and  $14.43$  for older and younger siblings, respectively) across three years and measured identity development in terms of commitment to school and work (e.g., being invested in and satisfied with school and work) and exploration of current commitments (e.g., talking about school and work with others and exploring new things about school and work). They conducted several path analyses and found small but significant effects ( $r = .13$  to  $.27$ ) indicating that older siblings had a greater influence over time on younger siblings' identity development than vice versa, particularly when the older sibling was of the same gender. Taken together, the results from these studies suggest that the direction of influence is more commonly downwards (older sibling to younger sibling) than upwards (younger sibling to older sibling).

***Younger sibling image of older sibling.*** An alternate way of conceptualizing status is by measuring the image an individual has of the model. Only two studies have measured younger sibling image of older sibling (Bouchey et al., 2010; Widmer & Weiss, 2000), and as summarized earlier, these findings are less clear than findings on birth order. Widmer and Weiss (2000) conducted a study of 148 sibling dyads and found that a positive younger sibling image of their older sibling was correlated with better psychological and academic outcomes for the younger sibling only when the older sibling also provided support ( $\beta = .41 - 1.18$  for interaction term). In contrast, Bouchey and colleagues examined the impact of younger adolescent siblings' academic image of their older sibling on academic adjustment and found no significant effects.

Given these differences in findings, it is difficult to draw definitive conclusions. Furthermore, because social learning processes and similarities in sibling outcomes were not measured, it is impossible to draw conclusions regarding the relationship between younger siblings' image of their older sibling and social learning. Nevertheless, the findings of Widmer and Weiss (2000) suggest that younger siblings' image of their older sibling may be an important aspect of the sibling relationship.

**Similarity.** Lastly, from a social learning perspective individuals are more likely to identify with models who are similar to them. However, Bandura (1969) proposed that similarity does not always lead to modeling. Instead, he suggested that modeling is more likely to occur when individuals not only share similarities but also have a history of common, or analogous, outcomes. In other words, similarity is more likely to lead to modeling when emulating a particular model's behavior in the past resulted in the same outcome for the individual as for the model.

Among all the variables theorized to lead to modeling, similarity is particularly complicated to study in the context of sibling relationships because it can be a component of both the predictor and outcome variables. However, sibling influence scholars have operationalized similarity as a predictor variable in terms of closer age spacing and same-gender constellation, thus avoiding this measurement concern. Most studies have found no evidence for a main effect of age spacing or gender constellation on self-reported sibling influence processes (Whiteman et al., 2007a, 2007b, 2010; Whiteman & Christiansen, 2008). However, although gender constellation and age spacing may not have a direct effect on sibling outcomes, it is possible that gender constellation moderates the relationship between other aspects of the sibling relationship and adolescent outcomes. For example, as reviewed in more detail above, Bouchey and colleagues (2010) found that older sibling support predicted a decline in younger sibling academic adjustment only in mixed-gender dyads and that a positive older sibling image predicted an increase in GPA only in same-gender dyads, and Milevsky and Levitt (2005) found that support from brothers was associated with different outcomes than support from sisters. Hence, gender constellation is an important aspect of sibling dyads that must be considered in sibling research.

In sum, social learning theory posits specific mechanisms that help explain how siblings can influence each other. Next, I review research that has examined some of these sibling influence mechanisms in the context of academic outcomes.

## **Sibling Influence on Academic Outcomes**

The literature examining sibling influence on academic outcomes is small but growing. One feature of the sibling relationship that has been examined in the context of academic outcomes is social support, typically measured as one construct consisting of several activities such as emotional support (e.g., encouragement) and instrumental support (e.g., helping with homework). Milevsky and Levitt (2005) investigated the role of social support from siblings on the academic adjustment of 695 adolescents ( $M_{\text{age}} = 12.69$  years). Each adolescent identified people in their life who were close and important to them and then clarified which persons provided various support functions (e.g., making them feel better when things bother them, helping them with homework, liking to be with them, and doing fun things with them). Support from brothers and sisters was calculated separately by averaging the number of support functions provided by all brothers and sisters named by participants. The academic adjustment composite was measured in terms of school attitudes (e.g., thinking that school is important), academic achievement (e.g., GPA, SAT scores), and school adaptation (e.g., behavior problems). Results indicated that gender was a moderator of the relationship between support and academic adjustment, and that this relationship also varied across measures of academic adjustment. Support from brothers predicted positive school attitudes for both male and female adolescents, but it predicted higher academic achievement only for male adolescents. Furthermore, the only significant effect of support from sisters was under conditions of high risk (e.g., poverty, high stress, single-parent home), such that adolescents in high-risk situations had higher school adaptation when they received more support from sisters. However, it should be noted that sibling support was averaged across all brothers and sisters rather than focusing on a particular sibling dyad, preventing any inferences about the effects of particular dyadic sibling relationships.

Another study asked 258 Latino adolescents ( $M_{\text{age}} = 17.26$ ) to rate the degree to which they received academic support from their siblings (e.g., motivating them to stay in school) and to assess the quality of their sibling relationship (Alfaro & Umaña-Taylor, 2010). Similar to Milevsky and Levitt's (2005) study, measures of sibling support and relationship quality were averaged across all siblings, rather than focusing on particular sibling dyads. These measures were then analyzed for their effect on academic motivation. Results indicated that the quality of the sibling relationship predicted sibling support ( $r = .36 - .37$ ). In addition, gender was a moderator. For boys, sibling support predicted academic motivation ( $r = .22$ ), but for girls support predicted academic motivation only in the context of high relationship quality ( $r = .10$ ).

These studies highlight the potential importance of sibling support and relationship quality in adolescents' academic outcomes, but they are limited in that they averaged sibling measures across all siblings in the family and thus do not provide insight into the role of support within a particular dyadic sibling relationship. However, two existing studies that focused on particular sibling dyads provide a more nuanced set of findings.

As previously mentioned, Widmer and Weiss (2000) collected data on school engagement (e.g., liking school) and school success (e.g., number of Ds/Fs, grade retention) from 148 adolescent sibling dyads. They also obtained measures of support provided to the younger sibling (e.g., helping them with homework or personal problems, taking care of them) and of the younger sibling's image of their older sibling (e.g., the older sibling is a good student, does what his/her parents want, and will do well in life). Contrary to what might be expected, support was associated with lower school success and engagement. However, this association changed when older sibling image was introduced as a moderator, such that when younger siblings had a

positive older sibling image, then support from their older sibling predicted higher school engagement.

Bouchev and colleagues (2010) extended Widmer and Weiss's (2000) cross-sectional study by conducting a longitudinal study of the role of older sibling support, older sibling achievement, and younger sibling image of their older sibling on younger sibling academic outcomes across the span of two years. Data from 341 sibling dyads ( $M_{\text{age}} = 15.00$  and 12.23 years at Time 1, respectively) was collected from both siblings at the beginning of the younger sibling's seventh-grade year (Time 1) and in the months following the end of their eighth-grade year (Time 2). Measures of older sibling support and younger sibling image of their older sibling were similar to those of Widmer and Weiss (2000), and older sibling academic engagement was measured by several items including grades and time spent on homework. Younger sibling academic adjustment was measured as GPA, perceived value of school, and academic self-concept. Results indicated that older sibling academic engagement predicted an increase in younger sibling academic adjustment, consistent with a modeling framework in which older siblings' academic behavior serves as an example for younger siblings to emulate. However, the role of older sibling support and image showed a moderating effect of gender constellation. Specifically, older sibling support predicted a decline in younger sibling academic adjustment for mixed-gender dyads only, and having a positive older sibling image predicted an increase in GPA for same-gender dyads only.

These studies raise two important points. First, it is notable that older sibling support tends to predict better academic outcomes when averaged across all siblings but worse academic outcomes when measured from a single older sibling. It is possible that the negative relationship between support from a specific sibling and academic achievement may reflect the greater need for support of younger siblings who are struggling academically. Rather than measuring emotional support, which is more closely related to closeness and intimacy, these studies appear to be measuring reactive support that is triggered by stressors (Jacobson, 1986). This suggests that support and intimacy are different dimensions of the sibling relationship that have differential effects on younger sibling outcomes and merit individual consideration. They also suggest that there may be different aspects of support that may have distinct effects on younger sibling outcomes.

Second, these studies provide evidence for modeling effects, where younger siblings with better academic outcomes tend to have older siblings who are higher achievers as measured either by older siblings' report of academic engagement or younger siblings' report of older sibling image. Taking into consideration the correlational studies that have shown that younger siblings who report looking to their older sibling as a role model have more similar academic outcomes to their older siblings, there appears to be strong evidence that the sibling relationship might play an important role in influencing younger siblings' academic achievement.

## **The Present Study**

The academic achievement of adolescent siblings has been studied at both the dyad (e.g., Whiteman et al., 2007a, 2010; Widmer & Weiss, 2000) and individual (e.g., Bouchev et al., 2010) level. In other words, some researchers have analyzed academic achievement at the dyad level by comparing the academic achievement of one sibling relative to the other, such as computing correlations between siblings' GPA, while others have examined predictors of the

academic achievement of only one member of the sibling dyad, typically the younger sibling. Drawing from an ecological framework in which individual adjustment is not independent of context (Jenkins & Dunn, 2009), this study will incorporate both approaches by analyzing the academic achievement of younger siblings in the context of the academic achievement of their older sibling.

**Dimensions of older sibling support.** The first aim of this study focused on older sibling support, a construct that has been measured in several ways. Measures of sibling intimacy typically include at least one question about emotional support (e.g., “How much do you go to this person for advice?” Blythe & Foster-Clark, 1987, p. 689), and measures of support typically include both general (e.g., “How often do you and your older sibling do things together?” Bouchey et al., p. 201) and instrumental (e.g., “How often does your older sibling help you with homework?” Bouchey et al., 2010, p. 201) types of support. However, it is possible that different aspects of older sibling academic support (e.g., encouragement, involvement, providing knowledge about available resources) exist and may differentially influence academic achievement (e.g., Malecki & Demaray, 2003).

Theories of social support are consistent with this possibility, and social support has been theorized to have four dimensions (emotional concern, instrumental aid, information about the environment, and appraisal about the self; Dunkel-Schetter et al., 1987). Hence, the first aim was to conduct an exploratory factor analysis of a scale measuring older sibling support for younger sibling academic plans and, if more than one factor was found, to include these as separate variables in the analyses described below. Based on previous research and theory highlighting four dimensions of support (Dunkel-Schetter et al., 1987; Malecki & Demaray, 2003), I hypothesized that four factors corresponding to the four theorized dimensions of support would be extracted.

**Sibling relationship predictors of younger sibling academic achievement.** The second aim of this study was to examine which aspects of the sibling relationship predicted the academic achievement of the younger sibling (YS) in the context of the older sibling’s (OS) academic achievement. Specifically, this aim focused on predictors of YS membership in one of four sibling achievement groups: YS low-OS low (LL), YS low-OS high (LH), YS high-OS low (HL), and YS high-OS high (HH). Several aspects of the sibling relationship were measured, and a MANCOVA and follow-up discriminant analysis were used to determine which of these variables best discriminated the four sibling achievement groups. Sibling intimacy was measured given its strong link to sibling similarities (e.g., Feinberg & Hetherington, 2000; Whiteman et al., 2007a, 2010). Older sibling support for younger sibling academic plans was measured separately from sibling intimacy given evidence that these might represent different dimensions of the sibling relationship (e.g., Alfaro & Umaña-Taylor, 2010). Younger sibling image of the older sibling was included in an attempt to clarify previously conflicting findings regarding the relationship between younger sibling image of the older sibling and younger sibling academic achievement (Bouchey et al., 2010; Widmer & Weiss, 2000).

Lastly, both aspects of older sibling influence (i.e., social learning and differentiation) were measured given recent research that has highlighted that these aspects of sibling influence might account at least in part for sibling similarities or differences in adjustment (e.g., Whiteman et al., 2007a, 2010). Structural dyad characteristics such as gender constellation and age gap

were also included in order to check for differences between groups. Based on previous research (e.g., Bouchey et al., 2010; Whiteman et al., 2011; Widmer & Weiss, 2000), I hypothesized that (a) intimacy, support, and social learning would be higher and differentiation lower in the same-achievement groups (i.e., HH and LL) than in the different-achievement groups, (b) older sibling image would be higher in the groups with high-achieving older siblings, and (c) younger sibling image of older sibling would be the strongest predictor of younger siblings' membership in the achievement groups.

Note that it was beyond the scope of this study to distinguish sibling dyad effects from parent-child effects. Previous research has found mixed findings regarding whether sibling and parent-child relationships are congruent or compensatory (e.g., Derkman, Engels, Kuntsche, van der Vorst, & Scholte, 2011; Feinberg, McHale, Crouter, & Cumsille, 2003), and this study focused on the relationship between various sibling relationship characteristics and academic outcomes. However, basic family characteristics such as sibling type (e.g., full, half, or step), family structure (e.g., single vs. two-parent), and family cohesion were included as control variables.

## **Method**

### **Participants**

Ninth- and tenth-grade students were recruited from one public and two private high schools in the San Francisco Bay Area. All ninth- and tenth-grade students from each school were recruited from core classes (e.g., English), and a total of 289 out of 795 (36%) students both had an older sibling and agreed to participate. Data were not analyzed for a sibling pair who were twins, so leaving a final sample size of 288 (52.8% female,  $M_{\text{age}} = 15.27$ ). Ninth and tenth graders were chosen given that it was likely that these students would be more aware of the implications of their academic achievement for post-secondary opportunities than younger students and also in order to maximize the likelihood that students would have an older sibling who can be an academic influence due to being in an academic environment currently or recently (e.g., high school, college). Recruitment took place at both public and private schools in order to increase the diversity of the sample. Participants' ethnicity was 29.5% White, 12.5% Black, 12.2% Hispanic, 10.1% Chinese, 10.1% Filipino, 13.9% multiethnic, 7.1% other Asian or Pacific Islander, and 3.5% other.

### **Procedures**

All study procedures were approved by the Committee for the Protection of Human Subjects of the University of California, Berkeley. Parent information letters were sent home with all 9<sup>th</sup> and 10<sup>th</sup> grade students prior to data collection, and approximately one week after information letters were sent home students were recruited from core 9<sup>th</sup> and 10<sup>th</sup> grade classrooms such that all students in 9<sup>th</sup> or 10<sup>th</sup> grade had the opportunity to participate. Students were explained study procedures and given an assent form. Those who had an older sibling and agreed to participate were then instructed to "Please answer the following questions about yourself and the older brother/sister that you're closest to." Students who completed the

questionnaire were given the option of leaving their email to be entered in a raffle for five \$30 Amazon.com gift cards.

## Measures

The questionnaire consisted of several demographic questions as well as specific questions about family and sibling relationship characteristics. Prior to data collection, sample questionnaires were administered to a small group of students. As a result of student feedback, minor modifications to the wording of some questions were made in order to ensure adequate understanding of the questions. A brief description of the sibling relationship variables is presented in Table 1.

**Family characteristics.** Students answered demographic questions about the family they live with at least four days per week. Data included family structure (two biological parent families, stepparent families, cohabiting stepparent families, and single parent families), ethnicity, immigrant status, and level of education of both mother and father figures as a proxy for socioeconomic status.

**Family cohesion.** Family cohesion was measured by the Family Relationship Scale-Cohesion (Tolan, Gorman-Smith, Huesmann, & Zelli, 1997), which consists of six statements about the family (e.g., “Family members feel very close to each other,” “Family members like to spend free time with each other”). Each statement was rated on a 5-point Likert scale (1 = never true, 5 = always true), and average scores were calculated across all six items. Scores on this scale have been shown to have acceptable internal reliability (Cronbach’s  $\alpha = .72$  in Tolan et al., 1997;  $.84$  in this sample) and be significantly correlated with additional measures of family functioning, including support, communication, and beliefs about family (Tolan et al., 1007).

**Parent expectations of achievement.** In order to measure parent educational expectations, students rated how important educational outcomes were to their parents. A total of five outcomes (e.g., attending school every day, getting a passing GPA, graduating from high school) were rated on a 5-point Likert scale on the basis of importance (1 = *not important*, 5 = *very important*), and average scores were obtained. An exploratory factor analysis (EFA) using a principal axis factoring extraction method with varimax rotation extracted a single factor evident on the scree plot. This factor accounted for 37.1% of the variance, and all items had loadings of at least  $.5$ . Scores in this sample had a Cronbach’s  $\alpha$  of  $.71$ .

**Sibling dyad characteristics.** Age and gender of both siblings were obtained and used to calculate age gap (difference between the age of each sibling) and create a gender constellation variable (same- or mixed-gender constellation). Data about the sibling structure (full biological, half, or stepsibling), birth order of both siblings, and duration of the sibling relationship (i.e., if they are not full biological siblings) were also obtained.

**Sibling intimacy.** Sibling intimacy was measured with four items asking about the frequency of behaviors indicating intimacy and closeness (e.g., “How much do you share your inner feelings with this person?” and “How much does this person understand what you’re really

like?"; Blyth & Foster-Clark, 1987). Each item was rated on a 3-point Likert scale (1 = *not at all*, 3 = *a lot*), and average scores were calculated. This scale was preferred to other sibling intimacy scales because it does not explicitly ask about modeling or instrumental support but instead focuses on the affective dimension of the sibling relationship. Scores on this scale have been shown to have acceptable internal reliability (Cronbach's  $\alpha > .77$  in Blyth & Foster-Clark, 1987; .74 in this sample) and be able to discriminate between more and less intimate relationships (e.g., parents versus aunts/uncles; Blyth & Foster-Clark, 1987).

**OS support for YS academic plans.** Younger siblings answered 28 items asking about different aspects of support for their academic plans provided by their older sibling. These items were adapted from the Contextual Support for Post-Secondary Plans-Sibling Scale (Ali et al., 2011), which focuses on support for post-secondary college and career plans and covers various dimensions of support such as encouragement, involvement, and providing knowledge about available resources. Items retained for this study were those that (a) were relevant to academic achievement (e.g., "This person knows which classes I am taking" and "This person helps me when my school work is difficult"), (b) could be adapted from career plans to academic achievement (e.g., "This person is helping me think about activities that are related to my academic achievement"), or (c) measured aspects of support not specific to academic achievement (e.g., "This person praises me when I accomplish a goal" and "This person reminds me to complete tasks in a timely manner"). Items that overlapped with items from the Sibling Influence Scale (e.g., "This person is someone that I can look to as a model" and "This person encourages me to join school activities"; Whiteman et al., 2010) were dropped.

Each item was rated on a 6-point Likert scale (1 = *strongly disagree*, 6 = *strongly agree*), and average scores were obtained. Scores on the original scale had excellent internal reliability (Cronbach's  $\alpha = .97$ ; Ali et al., 2011). As a result of the exploratory factor analysis described below, four subscales were created: encouragement, goal setting, OS academic engagement, and involvement. Reliability scores for subscale scores in this sample are reported in detail below.

**YS image of OS.** Younger sibling image of their older sibling was measured by the same four-item scale used by Widmer and Weiss (2000). Each item has a statement about the older sibling (e.g., "My older sibling is a good student" and "My older sibling usually does what my parents want"). Younger siblings rated each item on a 4-point Likert scale (1 = *strongly disagree*, 4 = *strongly agree*), and average scores were obtained. Scores on this scale have been shown to have good internal reliability (Cronbach's  $\alpha = .80$  in Widmer & Weiss, 2000; .78 in this sample) and be positively correlated with older sibling resourcefulness, school engagement, and school success (Widmer & Weiss, 2000).

**OS influence.** The Sibling Influence Scale (Whiteman et al., 2010) consists of 18 items that measure the extent to which younger sibling try to be like or different from their older sibling. Items were rated on a 5-point Likert scale (1 = *never*, 5 = *very often*) and made up two subscales, Social Learning (8 items) and Differentiation (9 items). Subscale scores were calculated by obtaining average scores across the corresponding items. Whiteman and colleagues (2010) found that scores on these subscales had good internal reliability (Cronbach's  $\alpha = .90$  and  $.85$  for the social learning and differentiation subscales, respectively), were not correlated with each other ( $r = -.05$ , *ns*), and were associated with the degree of similarity or

difference between siblings' outcomes. Social learning and differentiation scores in this sample also had good internal reliability (Cronbach's  $\alpha = .91$  and  $.88$ , respectively) and were not significantly correlated with each other ( $r = -.07$ ). Social learning and differentiation scores were analyzed separately.

**Academic achievement.** Younger siblings reported their own and their older siblings' English, Mathematics, Science, and Social Studies letter grades on the last report card. Letter grades were used to calculate GPA according to standard letter grade weights (A = 4, B = 3, C = 2, D = 1, F = 0). GPA scores were then standardized according to the mean GPA of participants within each school, and a median standardized GPA split was used to categorize younger and older siblings as either high or low achievers. This approach was used rather than using outer thirds or quartiles in order to include all participants. In addition, younger siblings provided a single-item global rating of their older sibling's grades on a 7-point Likert scale (1 = very low grades, 7 = very good grades).

### **Data Analyses**

Analyses were conducted using the Statistical Package for the Social Sciences (SPSS) for PC (IBM, 2012). Descriptive statistics of all participants as well as the four achievement groups were obtained, and intercorrelations between predictor variables were calculated. One-way analyses of variance (ANOVAs) were conducted to test for significant differences in family cohesion, parental expectations of achievement, and age gap across the four groups. A chi-square test of independence was conducted to test for equal distributions of family structure (two biological parents, stepparents, cohabiting stepparents, or single parent), mother and father education levels, sibling structure (full biological, half, or step), and gender constellation (same- or mixed-gender constellation) across groups.

Next, an exploratory factor analysis (EFA) was conducted on the Sibling Support for Academic Plans Scale. Ali and colleagues (2011) previously conducted a similar analysis on the original Contextual Support for Post-Secondary Plans-Sibling Scale in order to determine whether different dimensions of support (e.g., encouragement, providing information about resources) could be distinguished, and they determined that a single-factor model (accounting for over 50% of the variance in scale scores) was the best fit for the data. However, given that this scale was adapted for this study with a focus on support for academic plans, I conducted an EFA to examine whether different dimensions of support would emerge. A principal axis factoring extraction method with varimax rotation was used.

Lastly, a multivariate analysis of covariance (MANCOVAs) and follow-up discriminant analysis (DAs) were conducted in order to examine which aspects of the sibling relationship predict younger siblings' group membership. The MANCOVA included group membership as the independent variable and the sibling relationship measures as the dependent variables. Demographic and dyad characteristics that were significantly different between groups were included as covariates. Follow-up discriminant analyses (DA) were conducted after each MANOVA in order to determine which sibling relationship variables best discriminate group membership.

## **Results**

## Descriptive Statistics

Participant characteristics are presented in Tables 1-3 for the entire sample as well as by achievement group. Achievement groups were created based on median split of YS GPA and global rating of OS overall grades. OS overall grades was a preferred measure of OS grades than OS GPA due to the high percentage of missing data on OS GPA (approximately 40% missing). However, OS overall grades were considered a valid substitute given the high correlation between OS GPA and OS overall grades in participants that provided data on both variables ( $r = .79$ ). A total of 271 participants were able to be categorized into one of four achievement groups: YS low-OS low (LL), YS low-OS high (LH), YS high-OS low (HL), and YS high-OS high (HH).

Multiple one-way ANOVAs and chi-squared tests of independence were conducted in order to detect group differences in any of the participant characteristics. One-way ANOVAs indicated a significant difference between the achievement groups only with regards to parent expectations of achievement,  $F(3, 266) = 5.56$ ,  $MSE = .90$ ,  $p = .001$ , partial  $\eta^2 = .06$ . Follow-up pairwise comparisons using Bonferroni adjustments indicated that parent expectations of achievement were significantly higher in the HH group than in both the LL ( $p = .001$ ,  $d = .67$ ) and the LH ( $p = .04$ ,  $d = .51$ ) groups (see Table 2). Chi-square tests of independence revealed a moderate significant effect of group on the distribution of sibling type,  $\chi^2(3) = 15.07$ ,  $p = .002$ , Cramer's  $v = .24$ , and family configuration,  $\chi^2(3) = 14.70$ ,  $p = .003$ , Cramer's  $v = .23$ , and a weak but significant effect of group on paternal level of education,  $\chi^2(9) = 19.45$ ,  $p = .022$ , Cramer's  $v = .17$ . Students in the HH group were more likely to live with both biological parents and have a full biological sibling as well as have a father who completed a Bachelor's degree or higher (see Tables 3 and 4). No significant differences were found between groups with regards to age gap, family cohesion, gender constellation, or birth order.

Intercorrelations among sibling relationship variables ranged from  $|.07|$  to  $|.81|$  (see Table 5). Patterns of significant correlations reflected the pattern of variables presumed to lead to social learning in Bandura's (1969) theory. For example, sibling intimacy was positively correlated with YS image of OS, OS support for YS academic plans, and social learning, and negatively correlated with differentiation.

## Factor Analysis of Sibling Support

An exploratory factor analysis (EFA) was conducted on OS support for YS academic plans. The initial analysis extracted four clearly interpretable factors that were evident on the scree plot and accounted for 63.46% of the variance. All items had loadings of at least .45 on one or more factors, and items were assigned to the factor on which they had the strongest loading. However, parallel analysis indicated that two factors should be retained for rotation, so both two- and three-factor structures were examined. The two-factor structure accounted for 56.17% of the variance and consisted of items with coefficients of at least .39 on their corresponding factor, but the subscales based on these factors were not clearly interpretable. The three-factor structure accounted for 60.33% of the variance and consisted of items with coefficients of at least .50 on their corresponding factor. Given that the four-factor structure from the initial analysis was consistent with theory and highlighted an additional dimension of

support from an older sibling relative to the three-factor structure, the four-factor structure was accepted.

Subscale names based on each of the four extracted factors were assigned based on the content of the items that were salient on the factor and represented four dimensions of sibling support: Encouragement, Goal Setting, OS Academic Engagement, and Involvement (see Table 6). Three out of four factors had additional cross-factor coefficients at the  $|\lambda|$  level, ranging from one item on Involvement (Factor 4) to four items on Encouragement (Factor 1). Items were assigned to the factors for which they were most salient. The Encouragement subscale consisted of 13 items, 11 of them with coefficients of .50 or higher. The Goal Setting subscale consisted of six items, all of them with coefficients of .57 or higher. The OS Academic Engagement subscale consisted of five items, all of them with coefficients of .53 or higher. Lastly, the Involvement subscale consisted of four items, three of them with coefficients of .50 or higher.

Cronbach's  $\alpha$  coefficients were calculated for the factors based on the items assigned to it. As evident in Table 6, the reliabilities were generally high and ranged from .75 to .95. Intercorrelations among subscales based on the factors were also high and statistically significant and ranged from .51 to .84.

### **Sibling Relationship Predictors of Academic Achievement Group**

A one-way MANCOVA was conducted to determine whether there were significant differences between the sibling achievement groups in the various sibling relationship variables: sibling intimacy, YS image of OS, social learning, differentiation, and the four OS support factors that were extracted in the EFA: Encouragement, Goal Setting, OS Academic Engagement, and Involvement. A MANCOVA was used rather than multiple ANCOVAs given the high intercorrelations between the sibling relationship variables (see Table 5). Due to the significant group differences that emerged during preliminary analyses, three variables were included as covariates: parent expectations of achievement, sibling type (dummy coded), and parental education (dummy coded). Mean values and standard deviations of the sibling relationship variables are presented in Table 8. The MANCOVA was statistically significant Wilks's  $\lambda = .65$ ,  $F(9, 226) = 4.42$ ,  $p < .001$ .

A follow-up discriminant analysis (DA) was conducted to determine which of these sibling relationship variables and covariates best predicted membership in the sibling achievement groups. Significant mean differences ( $p < .05$ ) between groups were observed for all the predictors with the exception of sibling intimacy and the dummy variable for paternal education-some college. Paternal education-BA or higher failed the tolerance test, indicating that it was too highly correlated or multicollinear with at least one other variable, and was not included in the analysis. Three discriminant functions emerged, but only the first two functions were significant ( $p < .001$  and  $p = .016$  for functions 1 and 2, respectively). These two functions accounted for 46% of the variability between groups.

The structure matrix for Functions 1 and 2 is displayed in Table 9. Based on meaningful structure and standardized function coefficients, the variables that contributed the most to Function 1 were OS Academic Engagement and YS image of OS. OS Academic Engagement shared approximately 68% of its variance with the function, followed by YS image of OS (65%). Hence, this function was named OS Academic Behavior due to the strong influence of the older sibling's academic behaviors. The variables that contributed most to Function 2 were sibling

type-biological and parent expectations of achievement. The sibling type-biological dummy variable shared approximately 25% of its variance with the function, followed by parent expectations of achievement (21%). Due to the strong influence of sibling type and parent expectations of achievement, this function was named Family Characteristics.

As illustrated in Figure 1, on average participants in the LL and HL groups rated themselves low on OS Academic Behavior (group centroids =  $-.87$  and  $-.71$ , respectively), indicating that older siblings in these groups did not generally demonstrate good academic behaviors, and participants the HH and LH groups rated themselves high on OS Academic Behavior (group centroids =  $.71$  and  $.63$ , respectively), indicating that older siblings in these groups did demonstrate good academic behaviors. In contrast, participants in the LL and LH groups were generally low on Family Characteristics (group centroids =  $-.39$  and  $-.32$ , respectively), indicating lower parent expectations of achievement and being less likely to have a full biological older sibling, while participants in the HL and HH groups were high on Family Characteristics (group centroids =  $.47$  and  $.71$ , respectively), indicating they had higher parent expectations of achievement and were more likely to have a full biological older sibling.

The cross-validated classification showed that overall 43% of younger siblings were correctly classified, which is an acceptable hit ratio relative to the 25% correct classification expected by chance classification. However, correct classification varied across groups. Siblings in the HH group had the highest and most consistent correct classification (63%), followed by siblings in the LH group (58%). Siblings in the LL and HL groups had more inconsistent classifications and were less likely to be correctly classified (40% and 37% correct classification, respectively).

**Group classification with OS GPA.** Analyses were rerun with an alternate group classification using OS GPA rather than a global rating of OS grades to determine whether classification accuracy was improved using a different measure of OS academic achievement. A total of 115 participants did not provide data about their older sibling's grades, and thus only the remaining 173 siblings were able to be classified into one of the four achievement groups.

Results with this alternate group classification were similar with regards to descriptive statistics and the MANCOVA. However, slightly different results were obtained in the DA. Significant mean differences were found in all variables except for goal setting, sibling type, and all of the paternal education dummy variables. Two significant functions emerged, accounting for a combined 54% of the variability between groups. Based on meaningful structure and standardized function coefficients (see Table 10), the variable that contributed the most to Function 1 was OS Academic Engagement, which shared 61% of its variance with the function. The variables that contributed the most to Function 2 were parent expectations of achievement and differentiation. Parent expectations of achievement shared 25% of its variance with the function, followed by differentiation (23%). The name for Function 1 was retained from the previous DA (OS Academic Behavior), but Function 2 was assigned a different name given the variables that contributed most to it (Parent Expectations and Differentiation).

As illustrated in Figure 2, on average participants in the LL and HL groups rated themselves low on OS Academic Behaviors (group centroids =  $-1.07$  and  $-.71$ , respectively) and the HH and LH groups rated themselves high (group centroids =  $.71$  and  $.44$ , respectively), similar to the previous DA. However, a different pattern was found with regards to Parent Expectations and Differentiation in this DA than in the previous DA. Participants in the LL and

LH groups rated themselves low on Parent Expectations and Differentiation (group centroids = -.71 and -.30, respectively). In contrast, participants in the HL group rated themselves high on this function (group centroid = .62), and those in the HH group were neither high nor low (group centroid = .00). Taking both functions into consideration, it appears that the LL group was categorized by being low on both OS Academic Behavior and Parent Expectations and Differentiation, the LH group being high in OS Academic Behavior but low on Parent Expectations and Differentiation, the HL group being low on OS Academic Behavior but high on Parent Expectations and Differentiation, and the HH group by being high on OS Academic Behavior and moderate on Parent Expectations and Differentiation.

The cross-validated classification was more accurate in this DA, indicating that overall 55% of younger siblings were correctly classified. Similar patterns were found with regards to which groups had the greatest proportion of correct classification, but classification for each group was improved relative to the previous DA. Approximately 81% of participants in the HH group were correctly classified, followed by participants in the LH group (70%), the HL group (46%), and the LL group (37%).

**Group classification using outer thirds.** Additional alternate analyses were conducted using outer thirds of YS and OS grades instead of a median split in order to determine whether classification accuracy was improved using a more stringent criterion for labeling younger and older siblings as high or low achievers. Due to both missing data and exclusion of cases in which one or both siblings had GPAs in the inner third, only 90 participants were able to be categorized into a group. Results were similar to previous analyses in terms of descriptive statistics, except that there was no longer a significant difference of groups on paternal education. The MANCOVA was still significant, and two significant functions emerged in the DA. Based on standardized and structure coefficients (see Table 11) OS Academic Engagement was still the variable that most strongly contributed to Function 1, sharing 57% of its variance with the function, but some differences emerged with regards to which variables contributed most to Function 2. Sibling intimacy shared 31% of its variance with Function 2, followed by YS image of OS (27%) and Goal Setting. The rate of correct cross-classification (52%) was higher than the original DA but not as high as the DA using a median split of YS and OS GPA. Approximately 75% of participants in the HH group were correctly classified, followed by participants in the LL group (48%), the HL group (37%), and the LH group (31%). Notably, there was a high rate of misclassification of participants in the LH group into the HH group (62%).

Based on higher rates of correct classification, it appeared that the analyses using a median split of the GPA of both siblings to create achievement groups best described the relationship between sibling relationship and family variables and younger siblings' group membership.

## Discussion

Previous studies have examined the influence of older siblings on younger siblings' academic achievement (e.g., Bouchey et al, 2010) as well as the influence of the sibling relationship on similarities between older and younger siblings' academic outcomes (Whiteman et al., 2007a, 2010; Widmer & Weiss, 2000). Important aspects of the sibling relationship that

have been highlighted in previous research include sibling intimacy, older sibling support, younger sibling image of the older sibling, social learning, and differentiation. The present study sought to expand on this research first by (a) examining whether older sibling support for younger sibling academic plans represented a single or multiple factors and second by (b) creating four groups based on both younger and older siblings' academic achievement and investigating which aspects of the sibling relationship predicted younger siblings' group membership.

### **Dimensions of Older Sibling Support**

Social support has been theorized to be composed of four distinct dimensions: emotional concern, instrumental support, informational support, and appraisal (Dunkel-Schetter et al., 1987). There is some evidence that particular dimensions of support from parents, teachers, classmates, and friends may differentially influence student outcomes (Malecki & Demaray, 2003), but no previous studies have directly examined whether there are distinct types of older sibling academic support and, if there are, whether these types of support have different effects on younger siblings' outcomes in the context of academic achievement. The present study conducted a factor analysis on a scale of older sibling support for younger sibling academic plans that revealed four distinct types of support corresponding to Encouragement, Goal Setting, OS Academic Engagement, and Involvement, consistent with the hypothesis that four factors would emerge.

Interestingly, the four factors that emerged did not fully correspond to the four dimensions proposed in the social support literature (e.g., Dunkel-Schetter et al., 1987). Encouragement contained elements of both appraisal (e.g., "My brother/sister praises me when I do well in school") and instrumental support (e.g., "My brother/sister helps me when my school work is difficult"), but the remaining factors did not correspond to any of the theorized dimension of social support. For example, Goal Setting consisted of the older sibling's behavior around helping the younger student set deadlines, schedule time, and create a plan to accomplish academic goals, all of which are behaviors that provide the younger sibling with structure and organization rather than instrumental support. OS Academic Engagement was more closely related to the modeling element of social learning theory (e.g., Bandura, 1969) and younger sibling image of the older sibling (e.g., Widmer & Weiss, 2000) than to social support, and Involvement focused specifically on older siblings' involvement in younger siblings' academic plans.

One possible explanation for the lack of correspondence between the theorized dimensions of social support and the factors of older sibling support for younger sibling academic plans extracted in this study is that support may have different dimensions depending on whether it is measured in terms of general social support or domain-specific support. When support within a particular domain, such as academic plans, is examined, the dimensions that emerge might be specific to that domain and not necessarily correspond to social support. If there are distinct dimensions of support depending on whether general social support or domain-specific support is measured, then the mixed findings in previous research regarding the role of older sibling support on academic outcomes might be explained by the lack of specificity in their measure of support (e.g., Bouchey et al., 2010; Milevsky & Levitt, 2005). Future research should further examine how these various types of support contribute to specific aspects of

academic outcomes (e.g., motivation, academic engagement) and whether different types of support from older siblings both emerge and have differential effects on younger sibling outcomes in other domains (e.g., social competence, risky behavior). Alternatively, it is possible that these factors of older sibling support might be unique to the sibling relationship within an academic context and might not emerge in other relationships (e.g., parents, peers, teachers) or in other domains (e.g., social competence, risky behavior). Future research should examine whether these factors of support generalize to other relationships and other contexts.

### **Sibling Relationship Predictors of Academic Achievement Group**

Previous research has examined sibling influence on academic outcomes either by comparing how similar siblings' outcomes are or how the sibling relationship impacts younger siblings' outcomes. However, this study combined these approaches by examining the influence of sibling relationship variables on younger siblings' group membership in one of four achievement groups based on their own and their older sibling's academic achievement. Results indicated that classification was most accurate (55% correct) when a median split of GPA was used as a measure of academic achievement for both siblings, rather than using a median or outer thirds split of younger sibling GPA and global rating of older sibling grades (43% and 52% correct for median and outer thirds split, respectively). Consistent with my hypothesis, the strongest predictor of group membership was OS academic engagement, a variable that focuses on the older sibling's behavior with regards to their own academic achievement and is closely related to younger siblings' image of their older sibling.

The primary importance of older sibling academic behaviors in predicting younger sibling academic achievement is consistent with findings in previous research indicating that older sibling academic engagement predicted an increase in younger siblings' academic adjustment over time (Bouchey et al., 2010). It is likely that, consistent with social learning theory (Bandura, 1969), the academic behaviors of older siblings might serve both as vicarious reinforcement and as an indicator of power status that increase the likelihood that the younger sibling will perform similar behaviors. Moreover, the important role of academic modeling in predicting a younger sibling's academic achievement might help explain the general finding that siblings tend to have similar levels of academic achievement during childhood and adolescence (e.g., Lewin et al., 1993; Widmer & Weiss, 2000).

The second strongest predictors were parent expectations of achievement and differentiation. The role of parent expectations of achievement is consistent with previous research that has shown that this construct has a strong influence on student outcomes, particularly in European American families (Yamamoto & Holloway, 2010). High parent expectations increase student motivation for achievement, promote academic self-efficacy, relate to greater parental involvement, and lead to higher teacher expectations, all of which in turn lead to higher student academic outcomes. In contrast, the important role of differentiation in predicting younger sibling's achievement is surprising given that previous research has shown that younger siblings who report trying to be different from their older sibling do not show a clear pattern with regards to differences between their own and their older sibling's outcomes (e.g., Whiteman et al., 2007a, 2010). In other words, instead of finding that differentiation is linked to greater differences between sibling outcomes, previous research has found no significant link. It is possible that differentiation is not independently related to similarities or

differences between siblings' academic outcomes but that it may become important in the context of other variables such as OS academic engagement and parent expectations of achievement.

The most accurate group classification was of students in the HH (81% correct) and LH (70% correct) groups. Students in these two groups tended to report high OS academic engagement, consistent with having a high-achieving older sibling. However, students in the LH group reported somewhat lower OS academic engagement than students in the HH group and also reported low parent expectations of achievement. This pattern suggests that although having a high-achieving older sibling is generally associated with higher achievement in younger siblings, low parent expectations of achievement can override this effect and make it more likely for younger siblings to be low achievers even though their older sibling sets a good example for them.

In contrast, classification of students whose older siblings were low achievers was less accurate (less than 50% correct for both the LL and HL groups), suggesting that sibling relationship factors may exert a weaker and less consistent influence on younger sibling outcomes when the older sibling is a low achiever. Although students in these groups tended to report low OS academic engagement, consistent with having a low-achieving older sibling, students in the HL group reported higher parent expectations of achievement and differentiation scores. In other words, younger siblings who wanted to be different from their low-achieving older siblings and whose parents had high expectations of academic achievement were more likely to be high achievers despite the negative example set by their older sibling.

It should be noted that although the sample used in this study was ethnically diverse, there were no significant differences in the distribution of ethnic groups across the four achievement groups. This suggests that sibling and family characteristics such as the sibling relationship, sibling type, family constellation, and parent expectations of achievement have a stronger effect on younger siblings' academic achievement than ethnicity per se. This possibility is further supported by the fact that classification was most accurate for younger siblings in the HH group, which were also more likely to live with both biological parents, have a full biological older sibling, and have a father who has completed a Bachelor's degree or higher. Given that belonging to a traditional family (i.e., two biological parents) with traditional (i.e., full biological) siblings as well as parent education are generally associated with higher academic achievement (e.g., Davis-Kean, 2005; Tillman, 2008), the high rate of correct cross-classification of students in the HH group may reflect the fact that these students were more likely to have a greater number of protective factors.

### **Limitations and Future Research**

Results of this study must be interpreted within the context of several limitations. First, this study was cross-sectional and did not allow for conclusions regarding the influence of the sibling relationship on later outcomes. Future studies should consider longitudinal designs such as that conducted by Bouchey and colleagues (2010) to provide insight regarding sibling relationship influences on outcomes across a period of time and the mechanisms that underlie this influence over time. Second, younger siblings were the sole responders of all data in this study, raising the possibility of responder bias. Although previous research has shown that younger siblings' perceptions of the sibling relationship are more strongly related to their own

outcomes than older siblings' reports of the relationship, (Bouchey et al., 2010), thus indicating that self-reported predictors are valid, future studies should seek to have more objective measures of outcomes (e.g., obtaining grades from school records rather than self-report questions). Third, the sample used in this study was diverse. It is possible that differences with regards to ethnicity do exist between the achievement groups, but that there was no sufficient statistical power to capture significant differences amongst the various ethnic groups.

## **Conclusion**

This study provides evidence that sibling relationships are multidimensional and can have a strong association with the academic outcomes of adolescent younger siblings. Older sibling academic engagement was the sibling relationship factor most strongly associated with younger siblings' academic outcomes, and additional factors that had a significant influence on younger siblings' academic outcomes included parent expectations of achievement and differentiation. Moreover, this influence was most consistent when the older sibling is a high achiever. These results raise two important directions for future research. First, although over 50% of younger siblings' achievement group membership was correctly predicted, which is considerably better than 25% accuracy due to chance, a high percentage of younger siblings were not correctly classified. Classification was most inaccurate when older siblings had low academic achievement, suggesting that other variables may be more influential on younger siblings when their older siblings do not set a good example for them. Future research should explore what these factors might be both at the sibling relationship level and at the family level, potentially using a longitudinal approach to gain insight as to how these factors may interact with each other over time to influence younger sibling academic achievement.

Second, the importance of both sibling relationship and parent factors in predicting younger siblings' outcomes raises the need for additional research on the interaction between sibling influence and family factors. Given that the sibling relationship is both nested within a family and has distinct influences, future research should use a multilevel approach with data from multiple informants in order to distinguish between family, parent, and sibling influences, consider the relative influence of multiple sibling relationships within the same family, and examine the relative contributions of each of these relationships (e.g., Jenkins, Rasbash, Leckie, Gass, & Dunn, 2012).

Finally, although it is tempting to draw definitive conclusions from this study regarding its implications on interventions targeted towards promoting high achievement in adolescents, it must be noted that such conclusions would be premature. This and other studies examining sibling relationships do highlight that older siblings can be salient role models in terms of academic achievement, but additional data must be acquired before recommendations can be made for interventions. For example, more research is needed regarding what processes underlie a younger sibling's decision to be like or different from their older sibling, particularly when the older sibling is a low achiever, and what the relative influence is of parent, family, and sibling variables. Focusing on sibling dyads where older siblings are low-achievers is an important direction for future research that will help inform practice and interventions that seek to narrow the achievement gap.

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Table 1  
*Description of Sibling Relationship Variables*

Predictor	Description	Sample Item
Sibling Intimacy (Blyth & Foster-Clark, 1987)	Younger sibling report of emotional closeness with older sibling	“How much do you share your inner feelings with this person?”
OS Support for YS Academic Plans <sup>a</sup>	Younger sibling report of older sibling support for younger sibling academic plans	
Encouragement (subscale)	Younger sibling report of older sibling praise around academic achievement and help with difficult school work or academically-related situations	“My brother/sister praises me when I do well in school”
Goal Setting (subscale)	Younger sibling report of older sibling help with setting goals, creating a plan, and managing time appropriately within the academic domain	“My brother/sister helps me create a plan to do well in school”
OS Academic Engagement (subscale)	Younger sibling report of older sibling goals, discussions, and accomplishments within the academic domain	“My brother/sister sets goals for his/her academic plans with parent(s)/guardians(s)”
Involvement (subscale)	Younger sibling report of older sibling involvement in younger sibling academic environment	“My brother/sister knows my teachers”
YS Image of OS (Widmer & Weiss, 2000)	Younger sibling report of the image they have of their older sibling	“My older sibling is a good student”
OS Influence (Whiteman et al., 2010) <sup>b</sup>	Younger sibling report of whether they try to be like or different from their older sibling	
Social Learning	Younger sibling report of how much they try to be like their older sibling	“My brother/sister sets an example for how to behave.”
Differentiation	Younger sibling report of how much they try to be different from their older sibling	“I live my life differently so I won’t be like my brother/sister”

<sup>a</sup>Subscales were extracted from the composite through an exploratory factor analysis.

<sup>b</sup>Composite score not used in analyses.

Table 2  
*Mean and Standard Deviation of Individual and Sibling Dyad Characteristics by Achievement Group<sup>a</sup>*

Characteristic	Low-Low (N = 65)		Low-High (N = 65)		High-Low (N = 58)		High-High (N = 81)		Total (N = 288)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
YS Age (in years)	15.27	0.67	15.38	0.75	15.23	0.64	15.15	0.65	15.27	0.69
OS Age (in years)	20.14	3.89	19.52	3.59	18.78	2.78	19.23	3.13	19.47	3.42
Age Gap (in years)	5.05	3.76	4.38	3.37	3.71	2.63	4.28	3.01	4.42	3.26
YS GPA	2.19	0.76	2.26	0.68	3.63	0.24	3.61	3.75	1.93	0.89
OS GPA	2.62	0.86	3.58	0.53	2.66	0.88	3.73	0.40	3.29	0.81
OS Overall Grades	4.17	0.98	6.58	0.50	4.24	0.89	6.53	0.50	5.50	1.37
Family Cohesion	3.51	0.84	3.85	0.77	3.78	0.82	3.82	0.83	3.75	0.83
Parent Expectations of Achievement*	4.62	0.51	4.70	0.45	4.77	0.40	4.88	0.21	4.75	0.41

<sup>a</sup>A total of N = 271 students were able to be categorized into an achievement group due to missing data.

\* p < .05

Table 3  
*Frequencies of Individual and Sibling Dyad Characteristics by Achievement Group<sup>a</sup>*

Characteristic	Low-Low (N = 65)		Low-High (N = 67)		High-Low (N = 58)		High-High (N = 81)		Total (N = 288)	
	N	% <sup>b</sup>	N	% <sup>b</sup>	N	% <sup>b</sup>	N	% <sup>b</sup>	N	% <sup>b</sup>
Gender Constellation (YS-OS)										
Male-Male	20	30.8	15	22.4	13	22.4	14	17.3	69	24.0
Male-Female	15	23.1	19	28.4	7	12.1	21	25.9	66	22.9
Female-Male	19	29.2	15	22.4	22	37.9	19	23.5	78	27.1
Female-Female	11	16.9	18	26.9	16	27.6	26	32.1	74	25.7
Birth order										
Consecutive pair	48	73.8	52	77.6	50	86.2	67	82.7	229	79.5%
Skip pair	17	26.2	14	20.9	7	12.1	12	14.8	52	18.1%
Sibling Type**										
Full biological	46	70.8	44	66.7	48	84.2	72	90.0	219	76.0
Half or step sibling	19	29.2	22	33.3	9	15.8	8	10.0	66	22.9
YS Grade										
9 <sup>th</sup>	25	53.8	34	50.7	30	51.7	47	58.0	156	54.2
10 <sup>th</sup>	30	46.2	33	49.3	28	48.3	34	42.0	132	45.8
OS Grade/ Education Level										
9 <sup>th</sup>	1	1.5	0	0.0	0	0.0	1	1.2	2	0.7
10 <sup>th</sup>	2	3.1	3	4.5	4	6.9	2	2.5	11	3.8
11 <sup>th</sup>	6	9.2	7	10.4	12	20.7	11	13.6	39	13.5
12 <sup>th</sup>	11	16.9	26	38.8	7	12.1	15	18.5	44	15.3
High school diploma	9	13.8	5	7.5	5	8.6	2	2.5	27	9.4
Dropped out of college	6	9.2	2	3.0	4	6.9	3	3.7	13	4.5
In college	22	33.8	26	38.8	24	41.4	38	46.9	113	39.2
Completed college	8	12.3	14	20.9	4	6.9	9	11.1	38	13.2

<sup>a</sup>A total of N = 271 students were able to be categorized into an achievement group due to missing data.

<sup>b</sup>Percentages within a given characteristic may not add up to 100% due to missing data.

\*\* p < .01

Table 4  
*Frequencies of Individual and Family Characteristics by Achievement Group<sup>a</sup>*

Characteristic	Low-Low (N = 65)		Low-High (N = 67)		High-Low (N = 58)		High-High (N = 81)		Total (N = 288)	
	N	% <sup>b</sup>	N	% <sup>b</sup>	N	% <sup>b</sup>	N	% <sup>b</sup>	N	% <sup>b</sup>
Student Immigrant Status										
Born in the U.S.	54	83.1	58	86.6	42	72.4	60	74.1	228	79.2
Born outside the U.S.	10	15.4	8	11.9	16	27.6	21	25.9	57	19.8
Parent Immigrant Status										
Both parents born in U.S.	40	61.5	33	49.3	23	39.7	33	40.7	139	48.3
One parent born outside the U.S.	8	12.3	11	16.4	9	15.5	10	12.3	38	13.2
Both parents born outside the U.S.	15	23.1	22	32.8	25	43.1	37	45.7	103	35.8
Family Configuration										
Both biological parents	29	44.6	38	56.7	40	69.0	59	72.8	172	59.7
Other	36	55.4	29	43.3	18	31.0	22	27.2	116	40.3
Total children in family										
2	15	23.1	13	19.4	25	43.1	34	42.0	90	31.3
3	18	27.7	16	23.9	13	22.4	19	23.5	70	24.3
4	12	18.5	16	23.9	5	8.6	14	17.3	52	18.1
5	12	18.5	6	9.0	7	12.1	8	9.9	34	11.8
6	6	9.2	3	4.5	5	8.6	3	3.7	18	6.3
7	0	0.0	6	9.0	2	3.4	1	1.2	10	3.5
8 or more	2	3.0	7	10.5	1	1.7	2	2.5	14	4.8
Maternal Education										
High school or less	23	38.5	24	35.8	17	29.3	23	28.4	92	31.9
Some college	13	20.0	15	22.4	14	24.1	13	16.0	60	20.8
Bachelor's Degree or higher	36	40.0	26	38.8	25	43.1	42	51.9	124	43.1
Paternal Education*										
High school or less	20	31.3	26	40.0	29	50.9	22	27.5	100	34.7
Some college	13	20.3	10	15.4	8	14.0	9	11.3	41	14.2
Bachelor's Degree or higher	26	40.6	22	33.8	19	33.3	46	57.5	117	40.6

<sup>a</sup>A total of N = 271 students were able to be categorized into an achievement group due to missing data.

<sup>b</sup>Percentages within a given characteristic may not add up to 100% due to missing data.

\* p < .05

Table 5  
*Intercorrelations of Sibling Relationship Measures*

Measure	1	2	3	4	5
1. Sibling Intimacy	—				
2. YS Image of OS	.33**	—			
3. OS Support for YS Academic Plans	.54**	.61**	—		
4. Social Learning	.60**	.56**	.81**	—	
5. Differentiation	-.12*	-.24**	-.08	-.07	—

Note. N = 280-288 due to missing data.

\* p < .05

\*\* p < .01



Table 6  
*Factor Loadings for Exploratory Factor Analysis with Varimax Rotation of Sibling Support*

Item	Encouragement	Goal Setting	OS Academic Engagement	Involvement
My brother/sister helps me feel confident that I can overcome obstacles to my academic goals.	<b>.73</b>	.33	.19	.23
My brother/sister praises me when I do well in school.	<b>.70</b>	.34	.25	.08
My brother/sister would help me get support with a difficult class.	<b>.70</b>	.24	.29	.23
My brother/sister praises me when I accomplish a goal.	<b>.69</b>	.26	.28	.14
My brother/sister helps me think ahead about problems I might face in my school performance.	<b>.66</b>	.34	.25	.30
My brother/sister shows me the correct way of doing something when I make a mistake.	<b>.62</b>	.31	.27	.18
My brother/sister is involved in many aspects of my life.	<b>.59</b>	.22	.19	.34
My brother/sister helps me when I have a problem at school.	<b>.58</b>	.37	.18	.44
My brother/sister asks me about school.	<b>.57</b>	.40	.32	.16
My brother/sister helps me when my school work is difficult.	<b>.53</b>	.38	.20	.37
My brother/sister talks to me about my school performance.	<b>.52</b>	.40	.36	.03
My brother/sister is helping me think about activities that are related to my school performance.	<b>.49</b>	.48	.25	.23
My brother/sister talks to me about what I am learning in my classes.	<b>.45</b>	.37	.33	.38
My brother/sister reminds me about important deadlines.	.35	<b>.76</b>	.20	.18
My brother/sister helps me schedule my time when I need it.	.27	<b>.70</b>	.17	.32
My brother/sister helps me create a plan to do well in school.	.41	<b>.69</b>	.31	.12
My brother/sister reminds me to finish tasks on time.	.40	<b>.69</b>	.25	.07
My brother/sister asks about my homework assignments.	.35	<b>.60</b>	.17	.34
My brother/sister is helping me set goals for my school performance.	.50	<b>.57</b>	.34	.03
My brother/sister sets goals for his/her academic plans with parent(s)/guardian(s).	.21	.18	<b>.81</b>	.26
My brother/sister frequently discusses his/her academic plans with parent(s)/guardian(s).	.18	.24	<b>.73</b>	.27
My brother/sister completes tasks on time.	.33	.15	<b>.67</b>	.14
My brother/sister has achieved all or most of what he/she has set out to accomplish.	.30	.22	<b>.67</b>	.16
My brother/sister frequently talks to me about his/her academic achievement.	.34	.36	<b>.53</b>	.24
My brother/sister knows my teachers.	.10	.03	.19	<b>.77</b>
My brother/sister attends school events related to my classes and activities.	.21	.31	.09	<b>.55</b>
My brother/sister knows which classes I am taking.	.27	.14	.40	<b>.50</b>
My brother/sister is or was actively involved in school activities.	.18	.14	.35	<b>.49</b>

Table 7  
*Intercorrelations and Reliability of OS Support for YS Academic Plans Subscales*

Factor	1	2	3	4	Cronbach's $\alpha$
1. Encouragement	—				.95
2. Goal Setting	.84**	—			.92
3. OS Academic Engagement	.68**	.62**	—		.90
4. Involvement	.61**	.51**	.57**	—	.75

\*\*  $p < .01$

Table 8  
*Means and Standard Deviations of Sibling Relationship Features by Achievement Group*

Feature	Low-Low (N = 65)		Low-High (N = 67)		High-Low (N = 58)		High-High (N = 81)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Sibling Intimacy	2.23	.51	2.29	.43	2.10	.54	2.31	.49
YS Image of OS	2.89	.61	3.50	.44	2.92	.57	3.51	.43
Social Learning	3.07	1.03	3.64	.83	3.10	1.01	3.68	.99
Differentiation	3.29	.82	3.00	.90	3.55	.89	3.04	.82
Encouragement	3.52	1.24	4.14	1.17	3.67	1.17	4.17	1.34
Goal Setting	2.93	1.37	3.41	1.41	2.88	1.27	3.43	1.43
OS Academic Engagement	3.36	1.29	4.80	.98	3.52	1.13	4.79	1.05
Involvement	3.12	1.33	3.73	1.32	3.63	1.19	4.10	1.23

Table 9  
*Factors Classifying Achievement Groups*

Variable	Manova univariate partial eta squared	Discriminant Analysis			
		Function 1: OS Academic Behavior		Function 2: Family Characteristics	
		Standardized Coefficients	Structure Coefficients	Standardized Coefficients	Structure Coefficients
OS Academic Engagement	.31	.75	.83	-.11	-.03
YS Image of OS	.31	.47	.81	-.07	-.06
Social Learning	.16	.25	.41	-.10	-.03
Encouragement	.16	-.31	.31	.35	.05
Goal Setting	.13	-.25	.25	-.37	-.07
Sibling Type: Biological	—	.01	.06	.43	.50
Parent Expectations of Achievement	—	.17	.26	.47	.46
Involvement	.30	-.14	.33	.36	.44
Family Configuration	—	.08	.18	.26	.41
Differentiation	.07	-.14	-.30	.26	.33
Paternal Education: Some College	—	-.15	-.08	-.17	-.29
Sibling Intimacy	.06	-.06	.17	-.37	-.24
Paternal Education: BA or Higher <sup>a</sup>	—	—	.15	—	.05
Paternal Education: High School	—	-.02	-.09	-.18	.17

<sup>a</sup>Variable not included in analysis due to failing tolerance test.

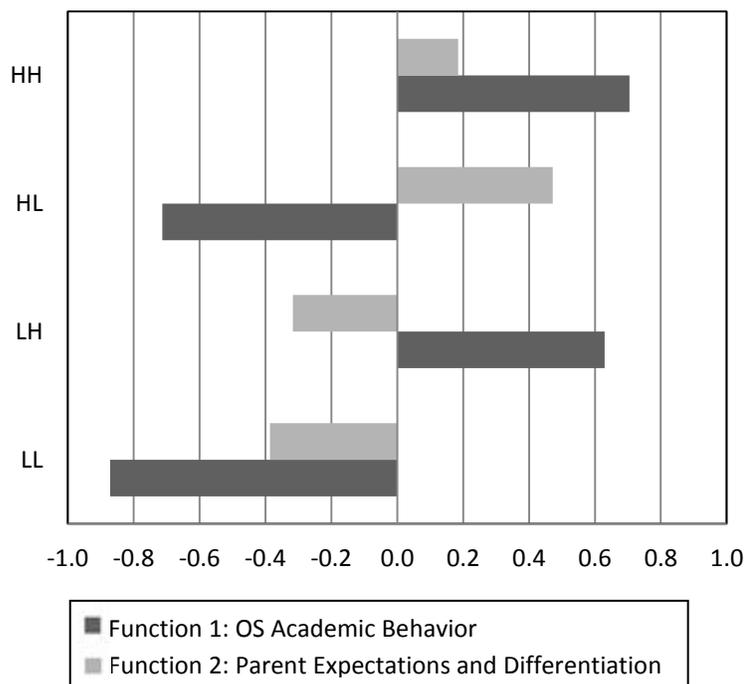
Table 10  
*Factors Classifying Achievement Groups using Older Sibling GPA*

Variable	Manova univariate partial eta squared	Discriminant Analysis			
		Function 1: OS Academic Behavior		Function 2: Family Expectations and Differentiation	
		Standardized Coefficients	Structure Coefficients	Standardized Coefficients	Structure Coefficients
OS Academic Engagement	.32	.77	.78	.00	-.17
YS Image of OS	.28	.24	.65	-.34	-.25
Involvement	.41	.20	.54	.30	.31
Encouragement	.18	.02	.38	.44	-.06
Social Learning	.17	-.03	.36	.07	-.10
Sibling Type: Biological	—	.20	.24	.12	.15
Goal Setting	.07	-.39	.24	-.44	-.13
Parent Expectations of Achievement	—	.23	.32	.43	.50
Differentiation	.11	-.18	-.32	.41	.48
Family Configuration	—	.08	.22	.38	.48
Sibling Intimacy	.12	-.02	.23	-.49	-.32
Paternal Education: BA or Higher <sup>a</sup>	—	—	.15	—	-.11
Paternal Education: High School	—	.05	-.05	.49	.03
Paternal Education: Some College	—	-.26	-.14	.24	.11

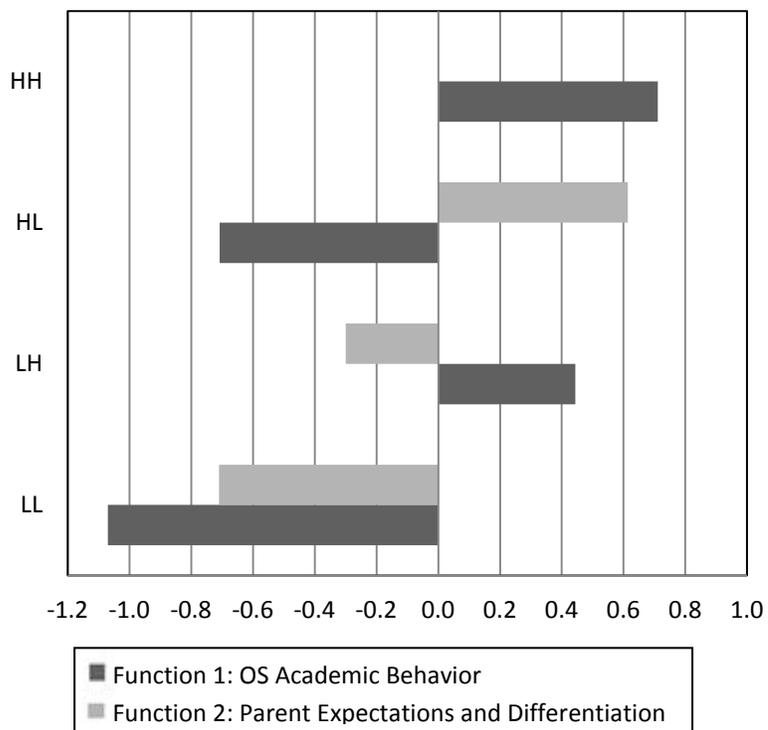
<sup>a</sup>Variable not included in analysis due to failing tolerance test.

Table 11  
*Factors Classifying Achievement Groups using Outer Thirds Split*

Variable	Manova univariate partial eta squared	Discriminant Analysis			
		Function 1: OS Academic Behavior		Function 2: Family Characteristics	
		Standardized Coefficients	Structure Coefficients	Standardized Coefficients	Structure Coefficients
OS Academic Engagement	.39	1.00	.76	-.62	.15
Involvement	.47	-.06	.52	.56	.32
Encouragement	.33	.06	.43	-.01	.35
Social Learning	.27	.23	.40	-.69	.26
Parent Expectations of Achievement	—	.39	.37	-.36	-.08
Sibling Type: Biological	—	.29	.30	-.31	-.02
Sibling Intimacy	.18	-.12	.22	.64	.56
YS Image of OS	.23	-.07	.47	.51	.52
Goal Setting	.20	-.49	.27	.69	.40
Differentiation	.09	-.26	-.20	-.44	-.36
Family Configuration	—	.25	.26	.09	.14

**Figure 1.** Group Centroids for Initial Discriminant Analysis

*Figure 1.* Group centroids for initial discriminant analysis. Groups were formed based on younger siblings' GPA and a global rating of older siblings' GPA. A total of 271 participants were able to be classified into a group.

**Figure 2.** Group Centroids for Alternate Discriminant Analysis

*Figure 2.* Group centroids for alternate discriminant analysis. Groups were formed based on both younger and older siblings' GPA. A total of 173 participants were able to be classified into a group.