Relationships Among Adolescents’ Perceptions of Friends’ Behaviors, Academic Self-Concept, and Math Performance

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Research suggests friendships play an important role in adolescents’ social well-being as well as affecting their academic motivation and academic performance. Still, how friendships actually affect academic outcomes is not completely understood, particularly the role of peer perceptions. The present study offers an empirical explanation for how perceptions of friends’ social and academic behaviors might affect academic outcomes. Using a nationally representative sample of 8,040 tenth graders, the authors tested a meditational model examining how perceptions of friends’ academic and social behaviors might affect math self-concept and math performance. Results suggest that perceptions of friends’ academic behaviors relate to academic performance, but only when perceptions align with one’s self-concept. Perceptions of friends’ social behaviors were negatively related to math self-concept and academic performance. Tests of gender moderation suggested negligible gender differences for how perceptions of friends’ social and academic behaviors related to math self-concept and math performance.

Keywords: friendship, academic self-concept, math performance, adolescence

Adolescent friendships include both academic and social factors that appear, coexist, and are concurrently maintained within school settings (Horst, Finney, & Barron, 2007; Wentzel, 2003a, 2003b, 2005; Wentzel & Caldwell, 1997). For instance, adolescents experience a variety of social pursuits within the classroom (Kiefer & Ryan, 2008; Simon, Aikins, & Prinstein, 2008; Wentzel, Barry, & Caldwell, 2004), and friends affect academic self-beliefs and academic performance (O’Donnell, 2006). Friendships at school improve adolescents’ academic engagement (Berndt & Keefe, 1995; Berndt, Laychak, & Park, 1990), even when friends share incorrect academic information (Nuthall, 2007). Adolescent friends actively acquire academic and social beliefs and behaviors from each other (Rubin, Bukowski, & Parker, 2006; Ryan, 2001). The transmission of academic and social beliefs may be particularly important among adolescents, who increasingly spend more time with, and increasingly value, their friendships (e.g., Brown, 2004; Larson & Richards, 1991).

Research indicates a relationship between adolescent friends and academic performance (Ryan, 2001; Wentzel et al., 2004), but several researchers note that the specific means by which friends alter academic outcomes are still not completely clear (Berndt, 1999; Birch & Ladd, 1996; Hartup & Stevens, 1997; Wentzel et al., 2004). Social-cognitive theory and peer emulation theory suggest that students’ self-beliefs, notably academic self-concept, may play a mediating role between friendship interactions and academic performance (Bandura, 1986; Baron & Kenny, 1986; Berndt, 1999). Social cognitive and peer emulation theory posit that friendship interactions directly affect academic self-concept. In turn, academic self-concept relates with academic performance (Marsh, 1986; Matthews, Zeidner, & Roberts, 2006). However, social cognitive and peer emulation theory do not suggest a direct link from friendship interactions to academic performance. Academic self-concept may therefore serve as a mediating variable between friendship interactions and academic performance (Baron & Kenny, 1986). We expand on existing theoretical and empirical research on friends and academic performance in the present study by proposing that academic self-concept plays a meditational role between adolescents’ friendship and academic performance.

How Friends Affect Self-Beliefs and Academic Performance

The adolescent peer environment is a multilevel, multifaceted environment that includes three main types of peer interactions: dyads (individual relationships), cliques (small groups of peers who regularly interact with each other), and crowds (adolescents who share the same reputation, but who may not necessarily interact with each other (Brown, 2004; Rubin et al., 2006). Each level of peer interaction has its own unique attributes and impact on students’ self-beliefs (Rubin et al., 2006). For example, reputation enhancement theory suggests that adolescents will change behaviors due to perceived social image within their larger peer crowd or network (Carroll, Baglioni, Houghton, & Bramston, 1999; Carroll, Durkin, Hattie, & Houghton, 1997). That is, adolescents are more willing to change their self-beliefs and behaviors when they are concerned with their reputation throughout the
social network, such as increasing delinquent behaviors in order to conform with perceived social norms (Carroll, Green, Houghton, & Wood, 2003; Carroll, Hattie, Durkin, & Houghton, 2001). Other self-beliefs and behaviors are affected by more immediate peer interactions, such as dyadic friendships and peer groups (e.g., Berndt & Keefe, 1996; Ryan, 2001). In the present study, we focused on the proximal role of dyadic and peer group friendship interactions in order to further examine how perceptions of friends might affect self-beliefs and behaviors.

Two psychological theories propose means by which friendships can alter self-beliefs and behaviors: social-cognitive theory (Bandura, 1986) and peer emulation theory (Berndt, 1999; Berndt & Keefe, 1996). Social-cognitive theory proposes that students acquire information about friends' academic and social behaviors through vicarious experiences and direct instruction (Bandura, 1986). After learning how their friends behave, the student may then alter her or his own academic behaviors (Bandura, 1986). It should be noted that there is often not a direct relationship from friends' behaviors to a student's academic performance. Rather, friends affect one's self-beliefs, which may then alter academic behaviors. For instance, a student may hear her or his friends talk about social activities (e.g., hanging out, romantic relationships), while little discussion is spent on academic pursuits (e.g., studying, thinking about college). The student therefore learns that social behaviors are highly valued, whereas academic pursuits are less valued. Acquiring these perceptions may subsequently lower the student's academic self-beliefs and affect academic performance.

Peer emulation theory proposes an individual may act comparably to their friends because friends adopt and reproduce each others' beliefs and behaviors (Berndt, 1999; Berndt & Keefe, 1996). The theoretical basis for peer emulation theory stems from processes of social influence by which individuals internalize and replicate others' actions and attitudes (Kelman, 1961). The three processes of social influence are compliance, identification, and internalization (Kelman, 1961). Compliance occurs when a person acquires another's behavior in order to gain favorable standing with that person. Compliance usually takes place under surveillance of the other person, so that person can provide social rewards for acquiring like characteristics. Identification is the adoption of easily observable behaviors in order to satisfy personal relationships with others. That is, an individual holds comparable beliefs to appease or please the other person. Internalization occurs when a behavior is acquired because it is congruent to one's value system. Internalization involves adopting another's behavior because it aligns with one's existing self-beliefs within a specific domain or topic. Identification and internalization may happen regardless of whether the person(s) originally demonstrating the behavior is present when the behavior or belief is reproduced. In summary, according to peer emulation theory, individuals may obtain and reproduce friends' characteristics through compliance, identification, and/or internalization of domain-specific beliefs or behaviors.

**Social-Cognitive Theory**

**Peer Emulation Theory**

**Perceptions of Friends’ Academic Behaviors**

As noted by Berndt and Keefe (1996), the majority of peer emulation research has focused on negative social behaviors (e.g., smoking, drinking, etc.), whereas much less is known about how peer emulation might function in regards to academic behaviors. Friendships are important contributors to students’ school engagement and adjustment (Ladd, Herald-Brown, & Kochel, 2009). This is especially true during adolescence when students increase social comparison of academic performance with classmates and peers (Eccles, 1999). Adolescents’ self-judgments depend on social comparison, normative standards, and behaviors that enhance interpersonal interactions and social appeal (Harter, 1990). Friends may compare and internalize a variety of academic behaviors and attitudes, such as attending class, studying together, sharing grades, and discussing plans to continue education past high school. Thus, it is important to examine the impact of perceptions of friends’ academic behaviors on individuals’ academic outcomes.

According to peer emulation theory, students’ academic self-concept should relate to their perceptions of friends’ academic behaviors. That is, students should internalize academic self-concepts congruent to their perceptions of friends’ academic behaviors. This should be a positive relationship between a student’s self-concept and their friends’ academic behaviors. If this relationship is negative, then students are not internalizing perceptions of friends’ academic behaviors or hold quite different perceptions of friends’ academic behaviors than their own academic self-concept. Social-cognitive theory proposes a comparable theoretical rationale where students model friends’ academic behaviors and hold comparable academic attitudes as what they perceive their friends having.

Although peer emulation may be a useful framework, the use of perceptual research has several limitations (Berndt, 1999; Berndt & Keefe, 1996; Rubin et al., 1998; Ryan, 2001). One limitation is that whereas peer emulation can involve an individual’s perception of their friends’ behaviors, an individual may emulate what he or she believes the friend is doing, and not necessarily the friend’s actual behavior. For example, a student may not push themselves to finish an assignment if they believe his or her friends are not doing the assignment (“Why should I do it if my friend isn’t doing it?”) regardless of whether that friend actually does the assignment. Although research suggests perceptions of friends’ behaviors impact adolescents’ educational outcomes (Wentzel, 2003a), the effect can disappear when friends’ actual behaviors and perceptions of friends’ behaviors are measured in tandem (Berndt & Keefe, 1995). Indeed, researchers have noted that actual behaviors are often overlooked in peer and friendship research (e.g., Berndt, 1999; Rubin et al., 1998; Ryan, 2001). However, to our knowledge, extant research has not examined the possibility that perceptions of friends’ academic behaviors are internalized and become intertwined with one’s self-beliefs as suggested by social cognitive and peer emulation theory. This is a potentially important omission as other studies suggest social comparison and internalized standards play a key role in adolescents’ self-esteem (Harter, 1990), perceived academic competence, and academic performance (Guay, Boiyin, & Hodges, 1999). Hence, it is possible that how students perceive their friends’ academic behaviors may affect students’ self-concept.

**Perceptions of Friends’ Social Behaviors**

Adolescents’ friendships are the accumulation of both academic and social exchanges. Students concurrently maintain both academic and social goals within the classroom (Horst et al., 2007;
Kiefer & Ryan, 2008; Wentzel, 2003b). That is, students learn academic content while managing their social relations (Wentzel, 2003b; Wentzel & Watkins, 2002). This might be particularly true during adolescence, when the salience and value of friendships increases (Harter, 2006; Larson & Richards, 1991).

The social element of friendships can include a variety of different behaviors and attitudes, such as hanging out, romantic relationships, and popularity. Adolescence is a time when romantic relationships become more important in developing students’ beliefs and behaviors (Simon et al., 2008). Popularity during adolescence affects such self-beliefs as self-esteem (De Bruyn & van den Boom, 2005) and academic performance (Cairns & Cairns, 1994). Given that romantic relationships and popularity affect adolescents’ academics, well-being, and self-esteem, it is possible that how students perceive their friends’ social behaviors may somehow affect students’ grades.

Social-cognitive theory suggests that perceiving friends as being too socially active may negatively and indirectly impact academic performance. For instance, a student may focus on and model friends’ social behaviors, while choosing not to model friends’ academic behaviors. Peer emulation theory suggests that a student’s academic self-concept may not be directly affected by friends’ social behaviors because internalization happens when self-beliefs align with the newly acquired behaviors. Hence, a student may not internalize the different domains of social and academic behaviors. We extend existing research in the present study by investigating how perceived friends’ social behaviors might pertain to adolescents’ academic self-concept and academic performance.

Gender, Friendships, and Academics

Adolescents’ gender may affect the relationship between peer perceptions and academic performance because peer interactions sometimes differ as a function of gender (Rose & Rudolph, 2006). Some reports suggest that males and females vary in the size of their peer groups, whereas other research refutes these findings (Benenson, 1990; Rose & Rudolph, 2006). Less understood is whether males and females perceive their friends’ behaviors differently for doing the same tasks. That is, present research does not report whether males and females hold similar perceptions of their friends’ academic (e.g., studying) or social (e.g., spending time with friends) behaviors. It may very well be that females, who frequently outperform males in the classroom, could have greater academic perceptions of friends than males, though this possibility has yet to be examined. It is also unclear as to whether or not gender may moderate the relationships between perceptions of friends’ academic and social behavior, academic self-concept, and academic performance.

How Academic Self-Concept Mediates Friends and Academic Performance

Academic self-concept is a collection of domain-specific self-perceptions and cognitive judgments of academic ability (Marsh, 1984; Marsh & Shavelson, 1985; Schunk & Pajares, 2007). Academic self-concept is a self-belief that reflects students’ past academic experiences (Bong & Skaalvik, 2003; Ferla, Valcke, & Cai, 2009) and is consistently related to academic performance (Ma & Kishor, 1997). Having high academic self-concept produces greater academic performance, and academic success increases academic self-concept (Matthews et al., 2006; Pintrich & Schunk, 2002).

Academic self-concept can also change depending on peer interactions and students’ environments (Gest, Rulison, Davidson, & Welsh, 2008; Marsh, 1986; Shavelson & Bolus, 1982; Trautwein, Lüdtke, Marsh, & Nagy, 2009). Students may compare their academic performance with others in order to evaluate their own self-competence, especially during adolescence (Harter, 2006). As such, academic self-concept may play a mediating role between friends and academic performance. Both social-cognitive theory and peer emulation theory propose that academic self-concept may mediate the relationship between friends and academic performance (Bandura, 1986; Birch & Ladd, 1996).

Using academic self-concept as a mediator between friends and academic performance allows researchers to connect external behaviors with internal, psychological states (Baron & Kenny, 1986; Holmebeck, 1997; James & Brett, 1984). Academic self-concept as a mediator variable may help explain the mechanisms by which the social and academic elements of friendships pertain to students’ academic performance (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). That is, if academic self-concept mediates the relationship between friends and academic performance, then academic self-concept might explain one way friends’ behaviors can, “take on internal psychological significance” (Baron & Kenny, 1986, p. 1176).

Overview of the Present Research

Research shows that friends and academic self-concept affect students’ academic performance. Less understood are the mechanisms explaining how friendships might impact academic performance, and whether academic self-concept might play a mitigating role. Hence, our aim was to address two outstanding issues in the present study. First, we examined whether perceptions of friends’ academic and social behaviors relate to students’ academic self-concept and academic performance. The second aim was to examine whether academic self-concept mediates the relationship between perceptions of friends’ academic and social behaviors and academic performance. We hypothesize that perceptions of friends’ academic behaviors will be associated with higher academic self-concept and academic performance, whereas perceptions of friends’ social behaviors will be associated with lower academic self-concept and academic performance. Furthermore, we hypothesize that academic self-concept will mediate the relationship between perceptions of friends’ behaviors and academic performance. We also explored whether any relationships between variables differ as a function of gender.

Method

Participants

The Education Longitudinal Study of 2002 (ELS: 2002). Participants for the present study came from the base year of the ELS: 2002. The ELS: 2002 is a national study following the
transition of adolescents from 10th grade through postsecondary education and into employment. The study includes a variety of psychological, academic, and social factors. The base year of ELS: 2002 included 17,591 students (87.3% student participation) from 752 different public, private, and parochial schools. Approximately 26 tenth graders from each school participated in the survey. 

**Present study.** The first step in choosing which students to include in the present study was whether participants had complete data for the present study’s variables. Only students with complete data were included in data analysis. This is a common procedure when using larger data sets, and is used with other ELS:2002 studies (e.g., Dumais, 2009). Next, linearity and multivariate normality were evaluated for 8,378 participants with complete data using SPSS 12.0. Mahalanobis distance calculated using all measured variables confirmed 338 multivariate outliers ($p < .001$), which were removed from subsequent analysis (Tabachnick & Fidell, 2001). This left the study with 8,040 10th graders ($n_{girls} = 4,211$; $52.4%$; $n_{males} = 3,829$, $47.6%$).

Participants’ demographics resembled the overall educational population in the United States. The sample was predominantly White, non-Hispanic ($n = 5,410$, $67.3%$); Hispanic ($n = 829$, $10.3%$); Asian, Hawaiian/Pacific Islander ($n = 729$, $9.1%$); and African American ($n = 726$, $9%$). A smaller group existed for students self-identifying as multiracial ($n = 346$, $4.3%$). Participants most often were attending public schools ($n = 6,116$, $76.1%$), with other students attending Catholic ($n = 1,245$, $15.5%$) or independent/private schools ($n = 679$, $8.4%$). Schools’ urbanicity was mostly suburban (51.1% of participants), with smaller amounts of urban (30.9%) and rural schools (18%). School locations were located fairly evenly across the United States (Northeast $n = 1,557$, $19.4%$; Midwest $n = 2,169$, $27%$; South $n = 2,710$, $33.7%$; West $n = 1,604$, $20%$). As described in the Results section, differences in ethnicity, school type, school urbanicity, and school location were controlled in the present study.

**Measures**

Perceptions of friends’ academic and social behaviors and beliefs. Participants answered several questions regarding their friends’ academic and social behaviors and beliefs. Students responded to eight questions on a 3-point Likert scale (1 = not important; 2 = somewhat important; 3 = very important). Four questions pertained to perceptions of friends’ academic behaviors and beliefs: Among your friends, how important is it to them that they . . . attend class regularly, study, get good grades, and continue their education past high school? ($\alpha = .82$). Another four questions related to perceptions of friends’ social behaviors and beliefs: Among your friends, how important is it to them that they . . . are popular/well-liked by others, have a steady boyfriend/girlfriend, hang out, and go to parties? ($\alpha = .69$).

Math self-concept. Students answered five questions pertaining to students’ math self-concepts. Students responded on a 4-point Likert scale (1 = almost never; 2 = sometimes; 3 = often; 4 = almost always). The individual questions were, “I’m confident that I can do an excellent job on my math tests”; “I’m certain I can master the skills being taught in my math class.” ($\alpha = .94$).

Math performance. In the present study, students’ math achievement scores came from a standardized test designed by members of the ELS: 2002 research team, which included associations with the National Center for Education Statistics. Questions came from previously successful standardized tests, such as National Education Longitudinal Study: 88, National Assessment of Educational Progress, and the Program for International Student Assessment. Math questions covered arithmetic, algebra, geometry, and data/probability.

In order to minimize floor and ceiling effects, students initially answered 15 routing test questions that determined which math questions would be asked in the second-stage math test. The second-stage math tests ranged from low (25 questions) to middle (27 questions) to high difficulty (27 questions). Results from the math tests were then standardized within the entire ELS: 2002 sample ($minimum = 19.38$, $maximum = 86.68$, $M = 50$, $SD = 10$).

**Socioeconomic status (SES).** SES rankings came from the ELS: 2002 composite variable. SES is an equally weighted and standardized combination of mother’s education, father’s education, mother’s income, father’s income, and family income. One parent reported this information via parent questionnaire.

**Procedure**

Purposive sampling occurred in order to achieve school demographics congruent to national averages. Once a school agreed to participate, students were then randomly selected from within the school. All students’ data were collected in the spring of 2002. All questionnaires, including those not included in the present study, were completed in less than 45 min. Participants received either $20 in cash or a $20 gift certificate for participating.

Math performance was tested on an individual basis if the student was the only one being surveyed in the school, but most testing occurred in small groups within school. Math performance tests were administered by trained assistants associated with the ELS: 2002 study. Student questionnaires were usually administered to students in small groups during school hours on school grounds. Math routing tests took 12 min, whereas the second stage took an additional 18 min.

**Results**

**Study Design and Analysis Plan**

We examined the relationship between perceptions of friends’ social and academic behaviors with math performance in the present study. We also explored how math self-concept might mediate the relationships between peer perceptions and math performance. We conducted data analyses in two stages. First, we conducted preliminary analyses in order to determine and control for differences in participants’ SES, ethnicity, school type (private, public, or parochial), school urbanicity (urban, suburban, or rural) and school location (Northeast, Midwest, South, or West). Second, we ran the primary structural analyses in order to confirm latent

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1 See http://nces.ed.gov/surveys/ELS2002/ for more details concerning students’ base year inclusion/exclusion in the study.
constructs, examine mediation effects in the proposed model, and test for possible gender effects in the final model. We ran all models with Mplus 3.13 (Müthen & Müthen, 1998–2004) with maximum likelihood (ML) as the estimation method. We evaluated all model paths with stringent alpha levels ($p < .001$).

**Preliminary Analyses**

Students’ individual differences often affect their academic performance (Gamoran, 1996; Ma & Klinger, 2000; Sander, 1996; Sirin, 2005; Stevenson, Chen, & Uttal, 1990; White, 1982). As such, we tested for possible differences in students’ SES, ethnicity, school type, school urbanicity, and school location on students’ math performance. A Pearson correlation indicated a significant positive correlation between SES and math performance, $r(8,040) = .39$, $p < .001$. An analysis of variance (ANOVA) on math performance suggested significant differences for ethnicity, $F(4, 8,040) = 202.05$, $p < .001$; school type, $F(2, 8,040) = 110.27$, $p < .001$; school urbanicity, $F(2, 8,040) = 6.37$, $p = .002$; and school location, $F(2, 8,040) = 10.02$, $p < .001$.

Given the significant differences between students’ individual differences and academic performance, we used multiple regression analysis to partially control for participants’ SES, ethnicity, school type, school urbanicity, and school location (e.g., Ma & Klinger, 2000; White, 1982). SES, ethnicity, school type, school urbanicity, and school location were predictor variables in the multiple regression analysis, with math performance as the criterion variable. The unstandardized residual was saved and used as the final measure of math performance. Thus, the unstandardized residual for math performance represents math performance that controls for students’ individual differences. This process was then repeated for all variables pertaining to students’ perceptions of friends’ social and academic behaviors as well as math self-concept. Table 1 reports correlations among the residualized variables and the means and standard deviations of the nonresidualized variables.

**Primary Analyses**

A nonsignificant chi-square is commonly used as an indicator of good model fit, but should not determine model fit on more complex and larger models (Schermelleh-Engel, Moosbrugger, & Müller, 2003). Hence, we used three additional fit indices less dependent on sample size and model parsimony in the present study: comparative fit index (CFI; Bentler, 1990), root-mean-square error of approximation (RMSEA; Steiger, 1990), and standardized root-mean-square residual (SRMR; Berndt, 1998). Adequate model fit occurs when the CFI approaches .95 in combination with RMSEA approximately less than .06 and SRMR less than .08 (Hu & Bentler, 1999).

**Confirmatory factor analysis.** The first step in the primary analyses was to run a confirmatory factor analysis to determine factor validity of the latent variables. The measurement model indicated adequate fit, $\chi^2(62, N = 8,040) = 2934.96$, $p < .001$; CFI = .95; RMSEA = .075; SRMR = .05; suggesting that the latent variables have strong factor validity. The factor loadings ranged between .54 and .89 (see Table 2) and were all statistically significant at $p < .001$.

**Structural model.** The second step in the primary analyses was to test math self-concept as a mediator between friends’ perceptions of academic and social behaviors and math performance. Cole and Maxwell (2003) suggest that mediation testing in structural equation modeling occur in two ways. First, a complete mediation model and a partial mediation model should be tested. Second, indirect effects should be examined to provide an estimate of the amount of mediation that has occurred. If indirect effects are not examined, then the relation among the variables has not been fully considered (Kline, 2005). We calculated indirect effects using Mplus (Müthen & Müthen, 1998–2004). In all models, we included a correlation between friends’ perceptions of academic behaviors and friends’ perceptions of social behaviors, as the same friends were possibly being tapped for both measures. The complete mediation model indicated adequate model fit, $\chi^2(74, N = 8,040) = 3,414.84$, $p < .001$; CFI = .94; RMSEA = .075; SRMR = .05 (see Figure 1).

We then tested a partial mediation model by measuring the addition of two direct paths, one at a time, to the mediated model. A direct path was first added from perceived friends’ academic behaviors to math performance. After evaluation, a direct path from perceived friends’ social behaviors to math performance was added. Adding a direct path from peer perceptions of friends’ academic behavior to math performance did not significantly contribute to the model, $\chi^2_{diff}(\Delta 1) = 0.06, ns$, nor was it a significant path ($\beta = -.00, ns$). That is, perceptions of friends’ academic behaviors were not directly related to math performance, but rather a statistically significant indirect effect existed through one’s math self-concept (see Table 3). This finding suggests that perceptions of friends’ academic behavior relates to math self-concept, which in turn corresponds to math performance.

In contrast to the first additional path, the partially mediated model was significantly different with the addition of a direct path from perception of friends’ social behavior to math performance, $\chi^2_{diff}(\Delta 1) = 36.52$, $p < .001$. Results indicated a significant negative relationship between perceptions of friends’ social behaviors and math performance ($\beta = -0.08, p < .001$). The negative relationship between perceived friends’ social behaviors and math performance suggests students have lower math performance when they perceive friends valuing social behaviors. Likewise, the relationship between perceived friends’ social behaviors and math self-concept was negative. Students have lower math self-concept when they perceive their friends as highly valuing partying, hanging out, and having a boy/girlfriend. As seen in Figure 2, the partially mediated model had adequate model fit, $\chi^2(73, N = 8,040) = 3378.32$, $p < .001$; CFI = .94; RMSEA = .075; SRMR = .05, and explained 16.5% of the variance in math achievement.

**Indirect effects of constructs’ shared variance.** As previously reported, perceptions of friends’ academic and social behaviors were related. It is important, then, to consider the effects of these constructs’ shared variance on math self-concept and math performance. We therefore examined the indirect effects of the shared variance on math self-concept and math performance. The total effect of perception of friends’ social behaviors on math self-concept became negligible and statistically nonsignificant.
Table 1

Correlations, Means, and Standard Deviations Among Variables for the SEM Model

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<td>3. Popular</td>
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<td>4. Boy/girlfriend</td>
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<td>5. Hang out</td>
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<td>6. Get good grades</td>
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<td>7. Attend class</td>
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<td>8. Study</td>
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<td>9. Continue education beyond high school</td>
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<td>Math self-concept</td>
<td></td>
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<tr>
<td>Math performance</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>10. Excellent job on assignments</td>
<td>0.39</td>
<td>-0.04</td>
<td>0.04</td>
<td>0.08</td>
<td>-0.05</td>
<td>0.18</td>
<td>0.18</td>
<td>0.15</td>
<td>0.19</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>11. Excellent job in class</td>
<td>0.41</td>
<td>-0.04</td>
<td>0.03</td>
<td>0.09</td>
<td>-0.06</td>
<td>0.14</td>
<td>0.15</td>
<td>0.10</td>
<td>0.16</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Understand difficult texts</td>
<td>0.38</td>
<td>0.03</td>
<td>0.04</td>
<td>0.06</td>
<td>-0.04</td>
<td>0.11</td>
<td>0.12</td>
<td>0.10</td>
<td>0.14</td>
<td>0.71</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Understand difficult class</td>
<td>0.36</td>
<td>-0.03</td>
<td>0.05</td>
<td>0.07</td>
<td>-0.03</td>
<td>0.14</td>
<td>0.15</td>
<td>0.12</td>
<td>0.16</td>
<td>0.79</td>
<td>0.73</td>
<td>0.77</td>
<td></td>
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</tr>
<tr>
<td>14. Master math class skills</td>
<td>0.38</td>
<td>-0.02</td>
<td>0.05</td>
<td>0.10</td>
<td>-0.03</td>
<td>0.17</td>
<td>0.17</td>
<td>0.14</td>
<td>0.19</td>
<td>0.83</td>
<td>0.72</td>
<td>0.72</td>
<td>0.78</td>
<td></td>
</tr>
</tbody>
</table>

**Note.** Correlations for males (n = 3,829) are reported below the diagonal; those for females (n = 4,211) are reported above the diagonal. SEM = structural equation modeling.

*p < .001.*
Table 2
Standardized and Unstandardized Coefficients for the CFA Measurement Model

<table>
<thead>
<tr>
<th>Latent and observed variable</th>
<th>β</th>
<th>B</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception of friends’ social behavior</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Party (S1)</td>
<td>.68</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>2. Popular (S2)</td>
<td>.58</td>
<td>.84</td>
<td>.02</td>
</tr>
<tr>
<td>3. Boy/girlfriend (S3)</td>
<td>.60</td>
<td>.70</td>
<td>.02</td>
</tr>
<tr>
<td>4. Hang out (S4)</td>
<td>.54</td>
<td>.76</td>
<td>.02</td>
</tr>
<tr>
<td>Perception of friends’ academic behavior</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Get good grades (A5)</td>
<td>.78</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>2. Attend Class (A6)</td>
<td>.75</td>
<td>.95</td>
<td>.02</td>
</tr>
<tr>
<td>3. Study (A7)</td>
<td>.75</td>
<td>1.01</td>
<td>.02</td>
</tr>
<tr>
<td>4. Continue education beyond high school (A8)</td>
<td>.67</td>
<td>.86</td>
<td>.02</td>
</tr>
<tr>
<td>Math self-concept</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Excellent job on assignments (M9)</td>
<td>.89</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>2. Excellent job in class (M10)</td>
<td>.84</td>
<td>.93</td>
<td>.01</td>
</tr>
<tr>
<td>3. Understand difficult texts (M11)</td>
<td>.84</td>
<td>.93</td>
<td>.01</td>
</tr>
<tr>
<td>4. Understand difficult class (M12)</td>
<td>.89</td>
<td>1.02</td>
<td>.01</td>
</tr>
<tr>
<td>5. Master math class skills (M13)</td>
<td>.89</td>
<td>1.00</td>
<td>.01</td>
</tr>
</tbody>
</table>

Note. CFA = confirmatory factor analysis. All variable loadings statistically significant at \( p < .001 \). Dashes indicate that there was no standard error due to factor loading being constrained to 1.0.

(\( β = −.02, ns \)). Thus, the total influence of perception of friends’ social behaviors on math self-concept was nonsignificant due to the shared variance of perception of friends’ social and academic behaviors. Results suggest no indirect effect of perceptions of friends’ academic behaviors on math performance via perceptions of friends’ social behaviors.

Multigroup analysis. Previous research suggests that gender influences both math beliefs and math performance (e.g., Hyde, Femmena, & Lamon, 1990; Stipek & Graliniski, 1991) as well as some potential differences in friendships (e.g., Rose & Rudolph, 2006). As such, we tested for gender effects using multigroup structural equation modeling (MSEM) in both the overall model and specific paths within the model. For the MSEM, we first analyzed a model in which all parameters were constrained to be equal for males (\( n = 3,829 \)) and females (\( n = 4,211 \)). We then unconstrained all parameters (with the exception of the factors of the latent variables) and compared the model fit with the constrained model via a chi-square difference test. A significant chi-square difference test would indicate a decrease in model fit between the group-specific model and the constrained model, and thus gender would be a significant moderator in this model. The chi-square difference test between the group-specific model and constrained model was significant, \( χ^2_{\text{diff}}(Δ5) = 114.43, p < .001 \), suggesting that there were differences in the overall model due to gender effects.

In order to determine which specific paths were moderated by gender, we unconstrained one parameter (path) at a time and compared it with the chi-square of the most recent significant model via chi-square difference test (Bollen & Long, 1993). One path differed as a function of gender, \( χ^2_{\text{diff}}(Δ1) = 34.66, p < .001 \). As seen in Figure 3, males had a stronger relationship between academic self-concept and math performance than females. One correlation between variables differed as a function of gender, \( χ^2_{\text{diff}}(Δ1) = 72.35, p < .001 \). The correlation between perception of friends’ academic and social behaviors was stronger for males than with females. We note that gender differences were statistically significant, but given only slight differences in scores, we believe they are not very practically significant. In addition, no other paths were significantly moderated by gender.

The final model fit the data well, \( χ^2(159, N = 8,040) = 3565.34, p = < .001, CFI = .94; RMSEA = .07; SRMR = .05 \) (see Figure 3). Although one path and one correlation differed as a function of gender, all the paths were statistically significant and in the same direction. Overall, the specific path coefficients moderated by gender were stronger for males than for females. For males, the variables explained 19.5% of the variance in math performance, whereas the variables explained 14.1% of the variance in math performance for females. The indirect effects are reported in Table 3.

Indirect effects of constructs’ shared variance. We examined the indirect effects of the shared variance between perception of friends’ academic and social behaviors on math self-concept and math performance. This time we tested for differences between males and females. For both males (\( β = −.01, ns \)) and females (\( β = −.04, ns \)), the total effects from perception of friends’ social behaviors to math self-concept became nonsignificant when the positive shared variance of perception of friends’ academic behaviors was taken into consideration. Thus, the indirect effect of perception of friends’ academic behaviors on math performance via perceptions of friends’ social behaviors was negligible.

Discussion

In the present study, we examined how perceptions of friends’ academic and social behaviors relate to math self-concept and math performance. Specifically, we investigated how perceptions of friends’ academic and social behaviors might relate to self-concept and academic performance. In addition, we aimed to examine whether self-concept might mediate the relationship between perceptions of friends’ behaviors and academic performance. The present study is one of the first to examine how perceptions of friends’ behaviors might directly relate to one’s self-beliefs, which then alter academic performance.

The study’s results fill an important gap in the research concerning friendships and academics. The extant literature has often examined how friend perceptions might affect outcome variables, such as grades (e.g., Berndt & Keefe, 1995; Wentzel, 2003a). Fewer studies examined how perceptions of friends’ academic and social behaviors might interrelate and pertain to one’s self-beliefs. We found that math self-concept played a mediating role between perceptions of friends’ academic and social behaviors and math performance.

Do Perceptions of Friends’ Academic and Social Behaviors Relate to Students’ Academic Self-Concept and Academic Performance?

In the study, we correlated perceptions of friends’ academic and social behaviors as adolescent friendships are a mixture of scholastic and nonscholastic experiences (e.g., Jones, Estell, & Alexander, 2008; Simon et al., 2008; Wentzel et al., 2004). Results suggested a very small correlation between perceptions of academic and social behav-
iors. These findings support the notion that whereas friendships include both academic and social factors, adolescents may view them as distinct domains within their friendships.

Results suggested that perceptions of friends’ academic behaviors were positively aligned with one’s math self-concept. In turn, math self-concept related to math performance. That math self-concept related to math performance is not surprising given that extant research indicates a strong relationship between self-concept and academic performance (e.g., Marsh, 1984; Matthews et al., 2006). More interesting is that perceptions of friends did not directly affect math performance. A nonsignificant relationship existed from perceptions of friends’ academic behaviors to math performance. Rather, there was a significant relationship between perceptions of friends’ academic behaviors and math self-concept. This indicates a path from perceptions of friends to the self and then to academic performance, instead of a direct route from friend perceptions to performance.

Perceptions of friends’ social behaviors were negatively related to math self-concept and math performance. Though these coefficients were statistically significant, they were quite low and likely an artifact of the study’s large sample size. This interpretation is supported when the unanalyzed associations of the shared variance of the two constructs are considered. The total effects of perceived social behaviors on math self-concept become statistically nonsignificant when the “indirect effects” of perceived academic behaviors are analyzed. Hence, we conclude that perceptions of friends’ social behaviors have, at best, a minimal relationship to academic self-concept and math performance.

Social-cognitive theory and peer emulation theory provide rationales for the study’s findings. Social-cognitive theory contends that the self (math self-concept) is the intermediary between the environment (perceptions of friends’ behaviors) and behavior (math performance; Bandura, 1986). In that regard, social-cognitive theory explains the study’s results concerning academic behaviors, but does not
easily explain how perceptions of friends’ social behaviors might pertain to math self-concept and math performance. Peer emulation theory (Berndt, 1999; Berndt & Keefe, 1996) offers a more straightforward rationale for the study’s results. As part of peer emulation theory, individuals will acquire others’ beliefs and behaviors if such beliefs and behaviors align with presently held attitudes (Kelman, 1961). This social mechanism, termed internalization, explains why perceived academic behaviors relate to math self-concept. Students likely hold self-beliefs congruent to how they view their friends’ attitudes toward school. The much weaker relationship between perceptions of social behaviors and math self-concept would be expected given the internalization process. A student should not have a particularly strong relationship between different domains: math self-concept and perceptions of friends’ social behaviors. Individuals are not likely to internalize and hold congruent beliefs within disparate domains unless by some chance association.

Do Students’ Academic Self-Concept Mediate the Relationship Between Perceptions of Friends’ Academic and Social Behaviors and Academic Performance?

Academic self-concept mediated the relationship between perceptions of friends’ academic behaviors and academic performance. The relationship between academic self-concept and academic performance was not particularly high, but congruent with findings from other meta-analytic and empirical studies (e.g., Ma & Kishor, 1997). Still, results from the present study suggest that perceptions of friends, specifically perceptions of friends’ academic behaviors, are an important contributor to academic performance, given that self-perceptions of friends align with one’s self-beliefs.

Results from the present study might partially explain conflicting research on the role of friendship perceptions and academic performance. Research suggests that perceptions of friends affect educational outcomes (e.g., Wentzel, 2003a). Other research indicates perceptions of friends are not as important as what the friend actually does (e.g., Berndt, 1999; Ryan, 2001). The disparity in research might be explained by the role of internalization. The present study suggests that students may internalize what they believe their friends value as long as it aligns with their own self-concept. Hence, perceptions of friends’ academic behaviors should affect educational outcomes only as a function of one’s self-beliefs. A student is more likely to internalize perceptions of friends’ academic behaviors with their math self-concept as academic and math self-beliefs are similar domains. Thus, perceptions of friends’ academic behaviors may be an important contributor to math performance when they align with one’s math self-concept.

The role of internalization may also help explain why perceptions of friends’ social behaviors had little relationship with academic self-concept and academic performance. A student may not internalize perceptions of friends’ social behaviors with their academic self-concept when adolescents perceive academic and social self-beliefs as different domains. That is, adolescents may view their academic self as distinct from their social self. Our results partially support this notion as perceptions of friends’ social behaviors minimally related with academic self-concept. Additional research is needed on students’ social self-beliefs to confirm this hypothesis. Still, the role of internalization helps provide insight into the differential findings regarding the relations between perceptions of friends’ academic and social behaviors, math self-concept, and math performance.

Other social influence processes may have occurred among friends that we could not readily examine in the present study, such as compliance and identification. With compliance, a friend acquires and reproduces others’ behaviors when friends are watching in order to gain status among their friends. Identification may have taken place if friends’ behaviors were adopted to appease or please friends. Compliance and identification may have taken place, but the study provides little direct evidence for such influence processes. Both compliance and identification involve the adoption and reproduction of behaviors with friends directly watching the emulated behavior. We focused more on perceptual issues in the present study, and not behaviors, among friends. Compliance and identification likely occurred among each participant, but we did not observe actual friendship behavioral exchanges in the present study. Future research would be needed to tease apart how internalization, compliance, and identification affect the emulation of friends’ beliefs and behaviors.

### Table 3

<table>
<thead>
<tr>
<th>Latent endogenous construct</th>
<th>General model math performance</th>
<th>Male math performance</th>
<th>Female math performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>B</td>
<td>SE</td>
</tr>
<tr>
<td>Social behavior</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Direct effect</td>
<td>−.08*</td>
<td>−1.42</td>
<td>.23</td>
</tr>
<tr>
<td>2. Specific indirect effects</td>
<td>−.02</td>
<td>−0.46</td>
<td>.11</td>
</tr>
<tr>
<td>3. Total effects</td>
<td>−.10*</td>
<td>−1.89</td>
<td>.25</td>
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<tr>
<td>Academic behavior</td>
<td></td>
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<td></td>
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<tr>
<td>4. Direct effect</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Specific indirect effects</td>
<td>.09*</td>
<td>1.82</td>
<td>.11</td>
</tr>
<tr>
<td>6. Total effects</td>
<td>.09*</td>
<td>1.82</td>
<td>.11</td>
</tr>
</tbody>
</table>

Note. Total effects may not be a composite of direct and indirect effects due to rounding. Dashes indicate that there was no direct effect for the academic behavior latent variable.

*p < .001.
Gender as a Moderator

Although there were no significant gender differences in the mean level of variables, relations between several variables were significantly moderated by gender, but this moderation is not considered to have much practical significance. Results indicated that the path from academic self-concept to math performance and the correlation between perception of friends’ social and academic behaviors differed as a function of gender. No other paths were significantly moderated by gender. The specific path coefficients moderated by gender were stronger for males than for females, and the model’s variables explained 5% more variance among males than females. This may be in line with previous research suggesting that other variables besides academic self-concept may help explain variance in math performance for females (Pomerantz, Altermatt, & Saxton, 2002; Pomerantz, Saxton, & Kenney, 2001).

It is important to note that all paths were statistically significant in the same direction. Thus, the strength of some associations was greater for males than females, but the mechanisms operated in a similar manner between genders. Furthermore, although these are statistically significant differences, we do not believe that the data imply much of a practically significant difference between males and females. These results align with other work showing some slight variation in peer interactions between males and females, but not for all social variables (Rose & Rudolph, 2006).

Limitations and Future Research

The present study contributes to knowledge about how perceptions of friends’ academic and social behaviors relate to math self-concept and math performance in adolescence. The study provides a new perspective in research by examining how perceptions of friends’ behaviors might mediate and pertain to adolescents’ self-beliefs by using a large, nationally representative sample (ELS: 2002). The results of the present study provide a general foundation for future work by using a national sample and con-
trolling for several individual variables. Future research could take a less general approach, and instead focus on individual schools and friendships across different developmental stages. It may be that the relationship between friends and academic performance is stronger within some school types, among certain friends, and vary depending on friends’ ages. Further investigation along these lines using a multilevel approach may be warranted.

We investigated in this study perceptions regarding friends, but did not take into account multiple factors of the adolescent peer world. Future work may examine the multiple levels of peer relationships in order to gain a more holistic perspective of how self-perceptions may be affected by the peer system (Brown, 2004). For example, future research could investigate the role of crowds in order to better understand how students’ desires to conform to larger social expectations within their grade level or school might affect self-beliefs (Carroll et al., 1999, 1997).

The present research is based on one time point. Thus, it is not known how results might vary if studied across multiple time points. Future research with a longitudinal sample could address this issue. Another avenue for future research is to expand the design of the present study to include younger students. Examining relationships between perceptions of friends’ behaviors, self-concept, and academic adjustment during middle childhood or early adolescence would be of interest as these are times when the self-concept is still developing and when individuals are most vulnerable to peer influence, respectively. It is possible that the process of internalization may look differently during these times.

An additional avenue for future research is to include a more comprehensive measure of perceptions of friends’ academic and social behaviors as well as measures of individuals’ and friends’ actual behaviors. This would help to disentangle the effects of internalization, compliance, and identification as well as peer perceptions from actual friend behaviors. Investigating actual adolescent friendship interactions is not easily done in nonlaboratory settings, but may offer a deeper understanding of how friendships affect academic performance. Lastly, we examined math perfor-

Figure 3. Final structural model moderated by gender. Standardized coefficients are reported first, followed by unstandardized coefficients and standard errors in italics. Standardized coefficients are not present for latent variable factor loading for presentation purposes. Paths that are moderated by gender report with males on the left and females on the right. * p < .001.
mance as an outcome variable in the present study. It is not clear how results might generalize to other content areas or to other aspects of adjustment. This would be a fruitful area for future research to investigate how perceptions of friends’ academic and social behaviors relate to aspects of academic and personal adjustment.

Conclusion

We expanded current understanding in the present research of how peer interactions relate to adolescents’ academic outcomes by examining relationships among perceptions of friends’ academic and social behaviors, academic self-concept, and math performance. Perceptions of friends’ academic behaviors were positively related to math self-concept. These perceptions did not directly affect math performance, but rather played a role in affecting math self-concept, which then related to math performance. In contrast, perceptions of friends’ social behaviors were negatively related to math self-concept and directly negatively related to math performance.

References


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