Perceived Social Support and Academic Achievement:

Cross-lagged Panel and Bivariate Growth Curve Analyses

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Abstract

As students transition to post-secondary education, they experience considerable stress and declines in academic performance. Perceived social support is thought to improve academic achievement by reducing stress. Longitudinal designs with three or more waves are needed in this area because they permit stronger causal inferences and help disentangle the direction of relationships. This study uses a cross-lagged panel and a bivariate growth curve analysis with a three-wave longitudinal design. Participants include 10,445 students (56% female; 12.6% born outside of Canada) transitioning to post-secondary education from ages 15-19. Self-report measures of academic achievement and a generalized measure of perceived social support were used. An increase in average relative standing in academic achievement predicted an increase in average relative standing on perceived social support two years later, but the reverse was not true. High levels of perceived social support at age 15 did not protect against declines in academic achievement over time. In sum, perceived social support appears to have no bearing on adolescents' future academic performance, despite commonly held assumptions of its importance.

Key words: academic achievement; grades; social support; gender; immigrant; longitudinal; adolescent;

Social support is positively correlated with academic achievement in adolescents and emerging adults (e.g., Robbins, Lauber, Le, Davis, Langley & Carlstrom, 2004). It is typically assumed that social support leads to increased academic achievement and most studies are designed with this theoretical assumption in mind (e.g., Cutrona, Cole, Colangelo, Assouline & Russell, 1994; DeBerad, Spielmans, & Julka, 2004). Longitudinal designs with three or more waves allow for stronger causal inferences and help disentangle the direction of relationships between two variables. These designs are a significant improvement over cross-sectional designs and allow researchers to test rival hypotheses, where academic achievement predicts change in social support. These rival hypotheses are consistent with the literature on self-esteem and academic achievement, which finds that self-esteem is an outcome, rather than an antecedent of academic achievement (Baumeister, Campbell, Krueger and Vohs, 2003). This study seeks to disentangle the direction of the relationship between academic achievement and perceived social support using a three-wave longitudinal design following students from age 15 to age 19. The longitudinal relationship between these variables has important pedagogical and policy implications for educators interested in improving academic performance in adolescents.

Social support and academic achievement

Lakey and Cohen (2000) identify two dimensions of social support: Received social support (i.e., frequency of supportive actions from others, such as advice and reassurance) and perceived social support (i.e., perceptions of how much social support one has available, if it were necessary). In this article, only perceived social support was examined. Theory on stress and coping suggests the cognitive interpretation of negative events (e.g., failing a test) plays a large role in how stressful those events will be (Lazarus & Folkman, 1984). Perceived social support is associated with more positive appraisals of one's ability to cope with negative events.

The transition from high school to post-secondary education is a highly stressful time for many adolescents. This transition period is associated with numerous stressors, including social isolation, academic pressure, financial difficulties and homesickness (Fisher & Hood, 1987). Such stressors contribute to heightened psychological distress, anxiety, depression, and health problems (Hicks & Heastie, 2008). The psychological distress associated with the transition to post-secondary education has a strong, negative effect on the academic achievement and post-secondary retention for freshman students (Hysenbegasi, Hass & Rowland, 2005). It is frequently assumed that increasing social support will serve as a buffer against these stressors. In this way, perceived social support is thought to contribute to improved academic performance distally by decreasing the stress of academic life (Lakey & Cohen, 2000).

Indeed, the positive relationship between perceived social support and academic achievement has been frequently demonstrated. Cross-sectional research suggests there is a positive correlation between perceived social support and grade point averages in high school (Domagala-Zysk, 2006; Rosenfeld, Richman & Bowen, 2000) with support from parents emerging as one of the most important sources of social support (Bahar, 2010; Rueger, Malecki, & Demaray, 2010). A meta-analysis of 33 studies (N = 12,366) found a positive correlation between perceived social support and Grade Point Average in post-secondary education (Robbins et al., 2004). Though the effect size was relatively small in this meta-analysis (r = .106), this cross-sectional relationship remains robust across studies with sufficient power to detect it. Though the cross-sectional relationship between social support and academic achievement is clear, the direction of this relationship remains contested. In order to make stronger causal inferences about directionality, longitudinal research – ideally with three or more measurement occasions – is required. Longitudinal research has many statistical benefits,

including the ability to control for base rates of variables and the ability to test reciprocal relationships (Curran, 2000). In the section that follows, a review of the longitudinal research examining the link between perceived social support and academic achievement is provided.

Longitudinal Research

Some prospective longitudinal research suggests social support predicts improvements in academic achievement over time. Cutrona et al. (1994) found that parental support – but not peer support – predicted future academic achievement, over and above baseline levels of academic ability. Another study found that peer and parental support longitudinally predicted positive academic behaviours (e.g., studying), though this relationship eroded as parental education decreased (Purswell, Yazedjian, & Toews, 2008). DeBerad et al. (2004) found that perceived social support uniquely predicted future academic achievement over and above a wide variety of other variables, including high school GPA, smoking and coping behaviours. Together, these studies support the notion that social support predicts higher grades in the future.

However, other lines of longitudinal research suggest that social support does not improve academic achievement. Grayson (2003) showed that early adjustment at university – which includes social support – has no impact on academic success in a Canadian sample. Dubois, Felner, Brand, Adan and Evans (1992) found that perceived social support from family, friends and school could not predict future grade-point average over and above prior levels of academic achievement and negative life events. Nicpon, Huser, Blanks, Sollenberger, Befort & Kurpius (2006) did not control for base rates of academic performance, but did find that perceived social support from family and friends was unrelated to future grade point average. The findings in the longitudinal literature on perceived social support and academic achievement are thus inconsistent.

All of the longitudinal studies reviewed above assumed social support led to increased academic performance. This was reflected in their analytic approach, which was typically regression-based with social support as a predictor and grade point average as the outcome. Given the inconsistencies in the longitudinal research, might it be that the assumed direction of causality is wrong? This would be consistent with research suggesting that students – particularly students from Chinese immigrant families – often feel parental support is contingent on performing well in school (e.g., Costigan, Hua & Su, 2010). Baumeister et al. (2003) have convincingly argued that general self-esteem is a consequence – but not a cause – of academic achievement (c.f. Marsh & Craven, 2006 for a counterpoint). The relationship between perceived social support and academic achievement might be similar; getting good grades might actually lead to perceptions of social support. Virtually no studies have tested this rival hypothesis against the theory that high social support leads to better grades. This article addresses this gap by conducting multi-wave longitudinal analyses which test for both possibilities simultaneously, thus providing a more stringent test of directionality.

Gender differences

There are some key gender differences in prior research. Governmental reports in Canada (Statistics Canada, 2008), the United States (Freeman, 2004) and the United Kingdom (Younger & Warrington, 2005) note that young boys may be "getting left behind" in the educational system, and highlight the need for interventions at the individual and institutional level. In particular, boys tend to score lower on verbal and writing skills than girls (Ma & Klinger, 2000). Though some research suggests that boys slightly outperform girls on standardized testing in mathematics, this gap has been narrowing and the effect size is small (Lauzon, 2001). Of course, there is a very apparent "glass ceiling" at the highest levels of graduate education; women

account for only 44% of all doctorates awarded in Canada (Statistics Canada, 2008). However, when studying overall academic achievement of adolescents aged 15-19, boys are more likely to emerge as disadvantaged. Girls also tend to perceive more social support from their peers than boys (Bogard, 2005; Furman & Buhrmester; Nicpon et al., 2006). This is likely due to gender differences in the way that girls approach relationships; girls tend to form a few close, empathetic relationships high in mutual disclosure, whereas boys tend to have larger, more extended friendship groups focused on tasks, competition and conflict (De Goede, Branje, & Meeus, 2009). On average, girls tend to have higher mean levels of academic achievement and perceived social support than boys.

There is also evidence suggesting that girls utilize social support in different ways then boys. Bogard (2005) found that social support from peers is associated with lower levels of depression, but only for boys. Altermatt (2007) found that increased social support from peers and family members after an academic failure tended to increase academic worry for girls, but not boys. Rueger et al. (2010) found that classmate social support was a predictor of academic performance for boys, but not for girls. Together, these results suggest that boys utilize peer social support in ways more conductive to improved academic performance than girls. Based on these results, it seems reasonable to expect that the relationship between social support and academic achievement would be stronger for boys than for girls.

Immigrant status differences

Immigrants to Canada may have systematic differences in their levels of social support and their academic performance. Intergenerational relations of immigrant families are less harmonious than those of non-immigrant families, which suggests lower family social support (Kwak, 2003). Moreover, sheer physical distance from one's family may be a particular concern

for international students. Nevertheless, academic performance of immigrants is comparable or better than Canadian-born students, overall. Immigrant children sometimes experience initial difficulties in reading and writing, but this difference disappears – or even reverses – as the students spend more time in the Canadian education system (Worswick, 2001). Immigrant students also tend to score higher in mathematics both in Canada (Areepattamannil & Freeman, 2008) and in the United States (Glick and White, 2003). Together, these results suggest that immigrants have lower levels of perceived social support, but are roughly equivalent in overall academic performance when compared to Canadian citizens. There is no strong evidence to support immigrant status as a moderator; social support appears to be equally important for both Canadian-born and immigrant students (Grayson, 2008).

Moving away from home

Evidence from qualitative (Wilcox, Winn & Fyvie-Gauld, 2005) and quantitative (Raviv, Keinan, Abazon, & Raviv, 1990) studies suggest that social support networks are greatly disrupted for students who move away from their parental home. Given the strong correlation between parental support and academic achievement as found in meta-analyses (e.g., Fan & Chen, 2001), it seems likely that students who move away from their parental home will experience decreases in their levels of academic achievement. However, there is also evidence suggesting that students who live on-campus have greater access to academic supports, have higher GPAs, and show increased academic persistence (e.g., Nicpon et al., 2006). Given the contradictory evidence, the potential role of living arrangements is currently unclear. Thus, whether or not students have moved away from their family home is included as an exploratory variable, without specific hypotheses.

The present research and hypotheses

Research questions are limited by the statistical procedures used. In this article, a cross-lagged panel analysis and a bivariate growth curve model are used to examine changes in social support and academic achievement over time (see Curran, 2000). A cross-lagged panel measures change in average relative standing. A bivariate growth curve measures within-person change over time. Though each model conceptualizes change differently, both models allow researchers to make stronger causal inferences when compared to cross-sectional data, and both allow for bi-directional relationships. These two statistical models are used to test hypotheses 1, 4 and 5. Gender and immigrant status differences are proposed in hypotheses 2 and 3. Each hypothesis is listed below. Higher average relative standing on perceived social support will predict higher average relative standing on academic achievement two years later, after controlling for prior levels of academic achievement (H1). Significant gender differences will emerge. Girls will have higher mean levels of social support and academic achievement than boys. In addition, the positive relationship between academic achievement and perceived social support will be greater for boys than for girls (H2). Significant differences based on immigrant status will emerge. Specifically, immigrants will have higher mean levels of social support compared to Canadian citizens. No moderation by immigrant status is expected (H3). Academic achievement will tend to decrease over time as students transition from high school to post-secondary education (H4). A higher level of perceived social support at age 15 will predict a less pronounced drop in academic achievement in students transitioning to post-secondary education (H5).

The above hypotheses are the most logical predictions based on prior theory suggesting that social support indirectly improves academic performance by reducing the stress of post-secondary transition (Lakey & Cohen, 2000), that boys and girls perceive and utilize social support in different ways (e.g., Rueger et al., 2010), and that immigrant children often have

disharmonious family relationships because of joint pressures to conform to both Canadian and their family's cultural beliefs (e.g., Kwak, 2003). Whether or not students have moved away from their family home is included as an exploratory variable, but there is insufficient research currently available to generate theory-driven hypotheses for this variable. The statistical models employed in this article are open to the possibility of rival hypotheses where academic achievement leads to changes in perceived social support (e.g., Baumeister et al., 2003). Hypotheses are thus theory-driven, but data analysis remains open to the possibility that theoretical revision is needed.

Method

Participants

Participants included people born in 1984 who were attending any form of schooling in Canada during the 1999/2000 school year. Data were acquired from a Statistics Canada dataset (Youth in Transition Survey). This longitudinal research had an initial sample size of 29,687 at the first measurement occasion. Cycle 1 occurred in the year 2000, and subsequent cycles occurred every two years. Only cycles 1 (age 15), 2 (age 17), and 3 (age 19) were analyzed. A sub-sample of participants (N = 10,445) who transitioned to university for the first time at either age 18 (n = 6262) or age 19 (n = 4183) was used. This subsample was selected to ensure that all participants in the sample were undergoing the same developmental transition to post-secondary education. This subsample was 56.0% female, 18.3% had moved away from their parental home permanently by age 19 and 12.6% were born outside Canada. Students' median income from all sources at Cycle 1 was $8232. Weighted data can be considered nationally representative of students who attend post-secondary education at age 18 or 19.

Procedure

The survey population was created by selecting a random sample of schools in Canada, then selecting a systematic equal-probability sample of no more than 35 students from each school. This created a hierarchical sampling design, with students nested within schools. Data were collected longitudinally across three cycles. During April and May of 2000 (age 15), students filled out a 30 minute pen-and-paper questionnaire which included information on transitions, education, employment and other background variables. In 2002 (age 17) and 2004 (age 19) students completed similar questions via a 45-minute phone interview. For this article, only self-reported grades, perceived social support, gender, country of birth and living arrangement status variables were used. For an in-depth description of methodology and sampling procedures, see the Statistics Canada website (Statistics Canada, 2011).

Materials

Demographic variables. Gender was measured as a dichotomous variable (i.e., male or female). Immigrant status was measured using a dichotomous variable representing the participants' country of birth (i.e., whether or not the participant was born in Canada). Living arrangement status was determined with a single yes/no question at age 19: "Do you consider yourself to have moved out permanently from the home of your parents or guardians?"

Perceived social support. Perceived social support was measured the same way across all three cycles using a modified short-form of the Social Provisions Scale originally developed by Cutrona and Russell (1987). This 6-item questionnaire was measured using a 4-point likert scale from 1 (strongly disagree) to 4 (strongly agree). Items included were (a) "If something went wrong, nobody would help me;" (b) I have family and friends who help me feel safe, secure and happy;" (c) "there is someone I trust whom I would turn to for advice if I were having problems;" (d) "there is no one I feel comfortable talking about problems with;" (e) "there is no

one I feel close to;" (f) "there are people I can count on in times of trouble." An item-response theory score was calculated using these 6 items, and the resulting score was standardized with a mean of 0 and a standard deviation of 1 using the entire YITS sample of N = 29,687. This scale had adequate alpha reliabilities across all three cycles (age 15 α = .84; age 17 α = .85; age 19 α = .86). The scale also displayed excellent construct validity (factor loadings ranged from .64 to .82), and criterion-based validity (the total score correlated .30 or higher with other measures of social support) across all three cycles (Statistics Canada, 2011).

Academic achievement. Academic achievement was measured using self-reported grades. High school grades at ages 15 and 17 were measured on a 7-point scale ranging from 1 (90% to 100%) to 7 (less than 50%). Age 19 grades were measured on a 6-point scale ranging from 1 (90% or above) to 6 (under 50%). At age 15, self-reported high school grades were measured by taking the average of four variables: English grade, science grade, math grade, and overall grade. At age 17, self-reported high school grades were measured by taking the average of three variables: Math grade, language grade, and overall grade. At age 19, self-reported post-secondary grades were measured with a single variable: overall grade. All variables were converted from their initial numeric codes into numeric grades out of 100% to promote ease of interpretation (e.g., "90% or higher" was recoded to 95%). Meta-analysis shows that self-reported grades correlate highly with grades obtained from official academic records (90% credibility interval of .70 to .94), which suggests that self-reported grades are a reasonably valid way of measuring academic achievement (Kuncel, Credé & Thomas, 2005).

Results

Data analytic strategy

Missing data analysis and tests of multivariate normality were conducted in SPSS 15.0 software to assess how missing data should be handled and whether or not a robust estimation procedure would be required. Descriptive statistics were calculated with sample weights derived by Statistics Canada to address over-sampling; descriptive statistics can thus be considered nationally representative. The remaining analyses were conducted with unweighted data. Because the complex sampling strategy created nested data (i.e., students nested within schools), a robust estimator of standard errors using the Huber-White sandwich estimator in Mplus 5.0 was required to account for this nesting. Bivariate correlations and significance testing for mean comparisons were calculated using this robust estimate of standard errors.

Data were analyzed using Mplus 5.0. Hypothesis 1 was tested using a cross-lagged panel analysis. Hypothesis 4 was tested with a univariate growth curve and hypothesis 5 was tested with a bivariate growth curve. Model fit was assessed using multiple fit indices. A well-fitting model is suggested by a non-significant chi-square, a χ^2/df ratio around 2, a comparative fit index (CFI) and a Tucker-Lewis index (TLI) around .95, and a root-mean-square error of approximation (RMSEA) around .08 (Kline, 2005). Robust estimates of standard errors which account for the nested nature of the data were used. Because all of the proposed moderating variables are dichotomous, multiple groups analysis (Byrne, 2001) was used to test for moderation by gender or immigrant status for hypotheses 2 and 3. In multiple groups analysis, two models are compared using a chi-squared difference test: A baseline model with all paths constrained to equality, and a nested model where all paths are allowed to freely vary. If this test is statistically significant, moderation has occurred. Because of the large sample, a critical value of .01 was used for p-values when determining statistical significance throughout the results.

Procedures to Account for Missing Data

Overall, only 2.94% of data were missing, and covariance coverage (i.e., the proportion of participants for which there is data on any given variable) ranged from 0.93 to 1.00. A significant Little's MCAR test, $\chi^2(86) = 158.08$, $p < .001$, revealed the data were not Missing Completely at Random. However, an examination of the separate variance t-tests using Missing Values Analysis in SPSS revealed that missing data could be significantly predicted by other variables in the model. Thus, the Missing at Random assumption was supported. To deal with missing data, a Full Information Maximum Likelihood Estimation approach was used. This approach provides unbiased parameter estimates and improves the statistical power of analyses when data are Missing at Random; it also represents a significant improvement over listwise deletion and single imputation (Enders & Bandalos, 2001).

Procedures to Account for Multivariate Non-Normality

Multivariate normality was assessed with Small's test, Srivastava's test and Mardia's test using a SPSS macro (DeCarlo, 1997). All but one of these diagnostic tests (Mardia's test of multivariate kurtosis) were statistically significant ($p < .01$), which suggests these data are multivariate non-normal. Under conditions of multivariate non-normality, non-robust estimation methods will tend to result in poorer indices of overall model fit (heightened Type II error) and smaller standard errors for path coefficients (heightened Type I error). To account for this bias, robust standard errors (using the Huber-White sandwich estimator) and a robust chi-square for determining model fit (Satorra-Bentler scaled chi-square) were calculated using the MLR estimator in Mplus 5.0 (Muthen & Muthen, 2007). Combined with the COMPLEX command in Mplus, this procedure can also account for the nested nature of the data.

Preliminary Data Analysis: Bivariate Correlations

Bivariate correlations are presented in Table 1. Broadly speaking, perceived social support was moderately stable across all three cycles (*r*s range from .33 to .46, $p < .01$). High-school grades at age 15 and age 17 were highly stable across time with a large effect size ($r = .72$, $p < .001$). The correlation between high school grades and post-secondary grades at age 19 was much smaller in effect size (*r*s range from .12 to .17, $p < .01$). Perceived social support was correlated with high school grades with a small effect size (*r*s range from .11 to .15, $p < .01$), consistent with prior meta-analyses (Robbins et al., 2004). Perceived social support at age 17 was weakly correlated with post-secondary grades at age 19 ($r = .03$, $p < .01$). Taken together, this pattern of results suggests there is merit in testing the proposed cross-lagged panel analysis.

Testing Hypothesis 1: Changes in Average Relative Standing

A cross-lagged panel model was fit to test hypothesis 1 (i.e., increases in average relative standing on social support predict increases in average relative standing in achievement). Both gender and immigrant status were entered in as covariates (i.e., correlated with all exogenous variables with a direct effect to all endogenous variables). Living arrangement status was not entered as a covariate because it did not predict social support or grades. Models run with living arrangement added as a covariate (or without any covariates) produces results similar to those depicted in Figure 1. Residual errors were allowed to correlate across cycles. Paths were not constrained to equality across waves. This model fit the data well: Satorra-Bentler $\chi^2(N=10445) = 7.56$, $p = .10$; $\chi^2/df = 1.89$; CFI = 1.00; TLI = .99; RMSEA = .01 (90% CI: .00, .02). Perceived social support ($\beta = .36$, $p < .001$) and self-reported grades ($\beta = .71$, $p < .001$) were relatively stable across time during high school. High school grades were a comparatively weak predictor of post-secondary grades at age 19 ($\beta = .16$, $p < .001$). The cross-lagged paths reveal that the relationship between perceived social support and grades is uni-directional: higher grades predict

higher perceived social support (βs range from .04 to .06, $p < .001$), but the reverse is not true (βs range from -.03 to .01, $p > .05$). These results are contrary to hypothesis 1. See figure 1 for a graphical depiction of results.

Testing Hypotheses 2 and 3: Gender and Immigrant Status Differences

Means, standard deviations, skewness and kurtosis values are presented in Table 2. Because weighted data were used, means can be considered nationally representative of this sub-population. Mean comparisons across gender, immigrant status and living arrangement are displayed in Table 3. Girls had higher levels of perceived social support and higher grades than boys across all three cycles, supporting hypothesis 2. Immigrants had lower perceived social support than non-immigrants across all three cycles, supporting hypothesis 3. All other mean comparisons were non-significant.

To test if gender, immigrant status or living arrangement moderated the relationship between perceived social support and self-reported grades within the context of the larger cross-lagged path model, three multiple groups analyses were conducted. The chi-squared difference tests for gender, immigrant status and living arrangement status were all non-significant. This indicates that the overall model did not differ based on gender $\chi^2(11) = 20.38$, $p > .01$, immigrant status $\chi^2(11) = 9.63$, $p > .01$ or living arrangement status $\chi^2(11) = 8.71$, $p > .01$.

Chi-square difference tests were also conducted for each separate path, by comparing models with a single path constrained to equality to a model with all paths freely estimated. See Table 4 for a list of all comparisons made across gender. Only one path emerged as different across demographic variables: The correlation between perceived social support and high-school grades at age 15 was higher for boys ($r = .16$, $p < .001$) than for girls ($r = .11$, $p < .001$), and this difference was statistically significant, $\chi^2(1) = 10.56$, $p < .01$. Thus, moderation by gender was

observed at age 15, partially supporting hypothesis 2. No other single path was moderated by gender, immigrant status or living arrangement status ($p > .01$). Thus, aside from the single exception noted above, the relationship between perceived social support and academic achievement was not moderated by any of these demographic variables.

Testing Hypotheses 4 and 5: Trajectories of Change over Time

Data were reanalyzed using univariate growth curves to answer hypothesis 4 (i.e., academic achievement decreases over time), and a bivariate growth curve to test hypothesis 5 (i.e., social support protects against decreases in academic achievement over time). Because there were only three measurement occasions, only linear growth trajectories can be modeled (Ong & Van Dulmen, 2007).

The univariate linear growth curve for social support was a reasonable fit to the data, [Satorra-Bentler $\chi^2(N=10445) = 14.12$, $p < .001$; $\chi^2/df = 14.12$; CFI = .99; TLI = .99; RMSEA = .04 (90% CI: .02, .05)]. However, the slope of this growth curve was nonsignificant (intercept = 0.07, $p < .001$; slope = 0.003, $p = .65$) suggesting that there is no systematic change in individual levels of perceived social support between ages 15, 17 and 19. Though social support did not show any systematic change over time, there was significant variability in the intercept ($\sigma^2 = 0.42$, $p < .001$) and slope ($\sigma^2 = 0.09$, $p < .001$), suggesting that on average there was not much change, but some youth saw increases in social support and other youth saw decreases.

The univariate linear growth curve for academic achievement was an adequate fit to the data, [Satorra-Bentler $\chi^2(N=10445) = 117.09$, $p < .001$; $\chi^2/df = 58.54$; CFI = .98; TLI = .97; RMSEA = .08 (90% CI: .07, .09]. The slope of this growth curve was significant and negative (intercept = 79.51, $p < .001$; slope = -1.28, $p < .001$) suggesting, on average, individual grades decreased by about 1.3 percentage points every two years, supporting hypothesis 4. There was

also significant variability in the intercept (σ^2 = 96.09, p < .001) and slope (σ^2 = 19.95, p < .001); though there was a slight decrease in grades on average from age 15 to age 19, there was still considerable variability within individuals.

The bivariate growth curve examines how the trajectory of social support was associated with the trajectory of academic achievement by including both growth curves in a single analysis. Both gender and immigrant statuses were included as time-invariant covariates. This model provided an adequate fit to the data [Satorra-Bentler χ^2(N=10445) = 79.33, p < .001; χ^2/df = 7.93; CFI = .99; TLI = 98; RMSEA = .03 (90% CI: .021, .032]. The intercept for social support and the intercept for academic achievement were positively correlated (β = .21, p < .001), suggesting that students with high levels of perceived social support at age 15 also tended to have high grades at age 15. The intercept for academic achievement was negatively correlated with the slope for academic achievement (β = -.84, p < .001), suggesting that students with the highest high-school grades at age 15 saw their grades drop the most once they entered post-secondary education. The slope for academic achievement and the slope for social support were positively correlated, (β = .09, p = .01), suggesting that change in academic achievement associated with change in perceived social support over time. The intercept for social support was negatively correlated with the slope for academic achievement (β = -.22, p < .001), suggesting that higher perceived social support at age 15 predicts a more pronounced decline in individual academic achievement over time (i.e., a larger within-person decrease over time). In contrast, the intercept for academic achievement was uncorrelated with the slope for social support (β = -.03, p = .33), suggesting that academic achievement at age 15 was unrelated to changes in social support. In sum, these results fail to support hypothesis 5; social support at age 15 does not protect students against a decline in achievement. In fact, post-secondary education

appears to "level the playing field" in terms of academic achievement, with the highest-performing high-school students experiencing the greatest decrease in their grades. These findings conceptualize change in a different way from the cross-lagged panel, and are not contradictory; both sets of findings are true for their particular conceptualizations of change over time.

Discussion

It is typically assumed that social support improves the academic achievement of adolescents. These assumptions are based on prior theory (e.g., Lakey & Cohen, 2000); however, there is a growing literature suggesting that psychosocial variables such as self-esteem are actually outcomes, rather than antecedents of academic achievement (Baumeister et al., 2003). Prior tests of the relationship between social support and academic achievement have been limited by the number of measurement occasions and the analytic strategy. Cross-sectional research cannot answer questions about directionality (Curran, 2000). The existing longitudinal research on this topic typically utilizes only two waves of data, and does not test the rival hypothesis that social support is an outcome of academic achievement (e.g., Cutrona et al., 1994). This research addresses these shortcomings by using a 3-wave longitudinal design analyzed using a cross-lagged panel and a bivariate growth curve, which allow researchers to make stronger causal inferences and test for effects in both directions simultaneously.

The cross-lagged panel analysis showed that a change in average relative standing in perceived social support predicts change in average relative standing in academic achievement two years later, but the reverse is not true. These results are contrary to hypothesis 1, but are in line with research suggesting psychosocial variables such as self-esteem are outcomes rather than antecedents of academic achievement (Baumeister et al., 2003). Univariate growth curves

showed that social support did not systematically change over time, but academic achievement tended to decrease over time, consistent with hypothesis 4. A bivariate growth curve failed to support the hypothesis 5, which suggested that social support at age 15 protects against declines in academic achievement over time. Instead, the bivariate growth curve suggested a significant and positive cross-sectional relationship between social support and academic achievement at age 15. It also showed that the students who had the highest levels of academic achievement at age 15 experienced the greatest declines when transitioning to post-secondary education, and high levels of social support offered no protection against this decline. In fact, decline in achievement over time was slightly more pronounced for students with high social support at age 15 because their grades were higher to begin with. In sum, high levels of perceived social support did not predict improvements in academic achievement over time, contrary to popular belief.

Mean levels of perceived social support and academic achievement were higher for girls than for boys and the cross-sectional relationship between these variables was larger for boys at age 15. Because this moderating effect was found only with cross-sectional data, causal inferences are limited; gender differences exist, but the processes leading to those differences are unknown. Regardless, the results for gender are consistent with prior research (e.g., Bogard, 2005; Rueger et al., 2010; Younger & Warrington, 2005) and partially support hypothesis 2. Immigrants had lower mean levels of perceived social support than Canadian-born participants, but did not differ in mean levels of academic achievement, and immigrant status did not moderate the relationship between achievement and social support, supporting hypothesis 3. These results are consistent with prior findings on immigrants and family support (e.g., Kwak, 2003), but did not replicate findings suggesting that immigrants have higher academic

performance; this latter finding may be because this research focused on overall grades rather than grades in mathematics (as in Areepattamannil & Freeman, 2008) or because the operational definition of immigrant status used only the participants' country of birth. These measures may be too crude to tease apart differences between immigrants and Canadian-born students. Unexpectedly, moving away from the parental home was entirely unrelated to perceived social support and academic achievement, which is somewhat inconsistent with past research (Fan & Chen, 2001). It is possible that a more refined measurement of living arrangement (e.g., living on-campus versus off-campus) might provide different results (e.g., Nicpon et al., 2006).

These results are in some ways counter-intuitive; most research begins with the assumption that social support leads to improvements in academic achievement (e.g., Cutrona et al., 1994; DeBerad et al., 2004). Instead, a cross-lagged panel reveals the opposite: Students perceive higher levels of support as a result of performing well in school. A bivariate growth curve suggests that social support does not protect against the decline in achievement over time. These results add a novel new perspective to research on social support and academic achievement by empirically testing causal pathways in *both* directions using multi-wave longitudinal data that controls for baseline levels of the variables of interest. The conclusion common to both of these analyses is straightforward: perceived social support does not improve academic performance over time in any appreciable way. Nevertheless, the conclusions that can be made based on longitudinal research depend a great deal on the length of the time lag. A time lag of 2 years may have been too large to capture dynamic processes between these variables. Thus, future research would do well to replicate these results using different time lags.

While mean levels of perceived social support were consistently higher for girls, the relationship between social support and academic achievement was larger for boys at age 15.

This is consistent with findings from Rueger et al. (2010), who found that boys tend to reap a variety of academic benefits from classmate social support, whereas girls did not. Altermatt (2007) suggests that girls experience greater academic worry when disclosing academic failures to friends; adolescent girls are more likely to engage in co-rumination (excessive discussion of personal problems) and may take feedback about failure more seriously than boys. These gendered differences in the way boys and girls communicate and develop friendships may play a major role in explaining this difference. This moderating effect was primarily cross-sectional (i.e., it occurred only for the correlation at age 15). Thus, any explanations suggesting cause and effect are speculative. This highlights the need for more nuanced time lags – perhaps studying social support both before and after individual exams – when studying this topic in future research.

Though the findings of this research suggest that perceived social support does not improve academic performance, this does not suggest that interventions designed to improve the social support networks of students should be abandoned. Indeed, interventions designed to increase students' levels of social support have a wide variety of benefits for students, including increased psychological adjustment and fewer behavioural problems (e.g., Pratt et al., 2000). Moreover, developmental theory suggests developing close, intimate relationships with others is a key developmental task of transitioning to young adulthood, so high levels of perceived social support remain important for the healthy psychosocial development of emerging adults (Erikson, 1950). There are thus many reasons why interventions might target the social support networks of students. Nevertheless, for interventions designed specifically to improve the academic performance of students, it would not seem prudent to focus primarily on improving social support. Instead, programs which focus on improving physical health (e.g., physical activity

breaks) and improving cognitive and social skills (e.g., decision making, goal-setting, conflict management, etc.) seem to be more consistently related to academic performance, especially when targeting at-risk groups (e.g., Brigman, & Campbell, 2003; Strong et al., 2005).

This research has several limitations. Perceived social support does not measure objective, practical help received from parents, friends or classmates. Instead, it represents a subjective sense of how much support would be available, were it necessary. Though perceived social support is related to received social support (Lakey & Cohen, 2000), they remain two distinct constructs with different theoretical approaches to measurement. The measure of perceived social support used in this study also could not differentiate between different sources of social support (e.g., parents, friends, teachers, etc.). Some research suggests parental support is the most important type of social support for adolescents (e.g., Cutrona et al., 1994). Thus, future research should include a multidimensional measure of perceived social support. The use of self-reported grades is another limitation; though there is a relatively high level of congruence between self-reported and actual grades (Kuncel et al., 2005), agreement is not perfect, particularly for students with low actual grades. Finally, because of the study design (e.g., post-secondary academic achievement was measured only during students' first year at university), only three measurement occasions could be used. Though this study represents a significant advance over cross-sectional studies, more measurement occasions would be valuable in future work.

Cross-lagged panel analysis tentatively supports a reverse causal hypothesis hereto untested in the literature: Social support is an outcome, not a predictor, of academic achievement. A bivariate growth curve showed that social support at age 15 could not protect against the decline in academic achievement experienced when transitioning to post-secondary

education. Cross-sectional findings also suggested the association between perceived social support and academic achievement is larger for boys than for girls. Future research should examine this relationship with measures of received and perceived social support as well as more objective measures of academic achievement. The direction of the relationship between social support and academic achievement is incredibly important for the development of future interventions, and merits additional research to confirm these counter-intuitive results.

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Table 1

Bivariate correlations

	1	2	3	4	5	6
1. Cycle 1 Social Support	1					
2. Cycle 2 Social Support	.38**	1				
3. Cycle 3 Social Support	.33**	.46**	1			
4. Cycle 1 Grades	.15**	.11**	.12**	1		
5. Cycle 2 Grades	.13**	.11**	.13**	.72**	1	
6. Cycle 3 Grades	.02	-.00	.03*	.12*	.17**	1

Note. Bivariate correlations around .10 can be considered small in effect size, around .30 can be considered medium and around .50 can be considered large. Bivariate correlations calculated using Mplus 5.0 to account for complex sampling (students nested in schools).

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

Table 2

Descriptive statistics

Variable	Mean	SD	Kurtosis	Skew
Cycle 1 Social Support	0.07	0.98	-1.11	-0.41
Cycle 2 Social Support	0.13	0.98	-1.15	-0.36
Cycle 3 Social Support	0.10	0.99	-1.19	-0.48
Cycle 1 Grades	78.10	9.63	-0.33	-0.39
Cycle 2 Grades	77.74	8.17	-0.50	-0.02
Cycle 3 Grades	76.06	9.40	0.42	-0.22

Note. Weighted data were used to calculate all descriptive statistics.

Table 3

Mean comparisons across demographic variables (standard deviations in parentheses)

Variable	Boys	Girls	Immigrant	Non-Immigrant	Moved Away	Living With Parents
Age 15 Social Support	-0.16 (0.98) [a]	0.24 (0.94) [a]	-0.06 (1.00) [b]	0.08 (0.98) [b]	0.02 (0.99)	0.07 (0.98)
Age 17 Social Support	-0.01 (0.98) [a]	0.23 (0.96) [a]	-0.03 (1.00) [b]	0.15 (0.97) [b]	0.12 (0.97)	0.12 (0.98)
Age 19 Social Support	-0.05 (0.99) [a]	0.21 (0.97) [a]	-0.12 (1.00) [b]	0.13 (0.98) [b]	0.12 (0.97)	0.09 (0.99)
Age 15 Grades	77.36 (9.50) [a]	78.66 (9.69) [a]	78.78 (9.66)	78.00 (9.61)	77.98 (9.99)	78.14 (9.55)
Age 17 Grades	76.58 (8.34) [a]	78.65 (7.93) [a]	78.85 (8.36)	77.62 (8.13)	77.67 (8.08)	77.78 (8.21)
Age 19 Grades	75.51 (9.70) [a]	76.49 (9.15) [a]	75.15 (9.05)	76.19 (9.43)	76.05 (9.70)	76.05 (9.37)

Note. Values outside parentheses represent weighted means. Values inside parentheses represent weighted standard deviations. Table 3 shows that (a) girls have significantly higher levels of perceived social support at ages 15, 17 and 19; (b) girls have significantly higher levels of academic achievement at ages 15, 17 and 19; and (c) immigrants have significantly lower levels of perceived social support ages 15, 17 and 19. No other mean comparisons across demographics were significant. Significance testing was conducted using Mplus 5.0 to implement a full information likelihood estimation method of dealing with missing data and to implement robust estimates of standard errors. N = 10,445.

[a] Statistically significant difference between boys and girls, $p < .001$.

[b] Statistically significant difference between immigrants and non-immigrants $p < .01$.

Table 4

Multiple groups analysis for gender

Model Description	χ^2 difference test
1. Allow all paths and correlations to freely vary	$\chi^2(11) = 20.38$, $p > .01$
2. Allow the path from age 15 social support to age 17 social support to freely vary	$\chi^2(1) = 0.01$, $p > .01$
3. Allow the path from age 17 social support to age 19 social support to freely vary	$\chi^2(1) = 0.17$, $p > .01$
4. Allow the path from age 15 academic achievement to age 17 academic achievement to freely vary	$\chi^2(1) = 3.94$, $p > .01$
5. Allow the path from age 17 academic achievement to age 19 academic achievement to freely vary	$\chi^2(1) = 1.07$, $p > .01$
6. Allow the path from age 15 academic achievement to age 17 social support to freely vary	$\chi^2(1) = 1.84$, $p > .01$
7. Allow the path from age 17 academic achievement to age 19 social support to freely vary	$\chi^2(1) = 4.57$, $p > .01$
8. Allow the path from age 15 social support to age 17 academic achievement to freely vary	$\chi^2(1) = 0.80$, $p > .01$
9. Allow the path from age 17 social support to age 19 academic achievement to freely vary	$\chi^2(1) = 0.25$, $p > .01$
10. Allow the correlation between age 15 social support and age 15 academic achievement to freely vary	$\chi^2(1) = 10.56$, $p < .01$*

Note. All models compared to a baseline model where all paths are constrained to equality across gender. If chi-square values are statistically significant, the new model represents a significant improvement over the baseline model. Because chi-square values cannot be directly compared when using robust estimation procedures, these values were calculated using log-likelihoods and account for the scaling correction factor. See the following website for more information: http://www.ats.ucla.edu/stat/mplus/faq/s_b_chi2.htm. N = 10,445.

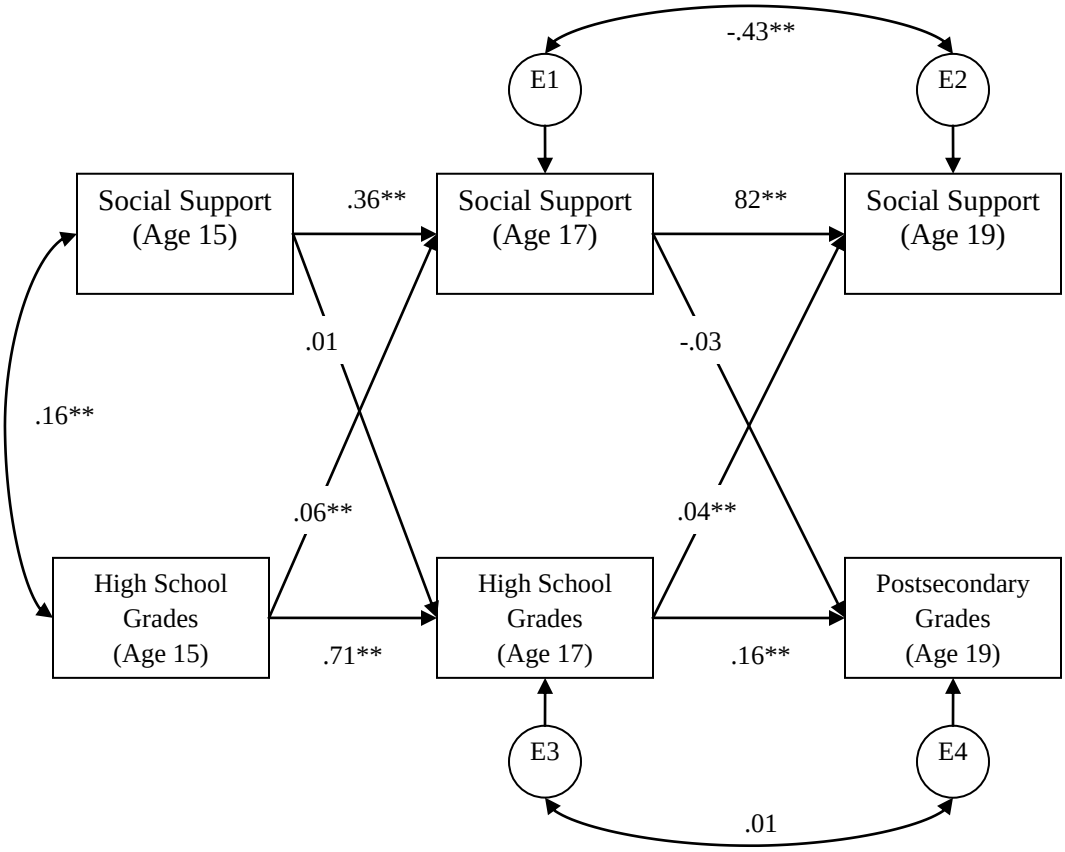

Figure 1. Cross-lagged panel analysis of social support and self-reported grades. Rectangles represent measured variables. Circles labelled E1-E4 represent residual error. Single headed arrows represent regression paths. Double-headed arrows represent correlations. All path coefficients and correlations reported represent standardized values. Sex and immigrant status were entered in as covariates in this model, but are not depicted for clarity.

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

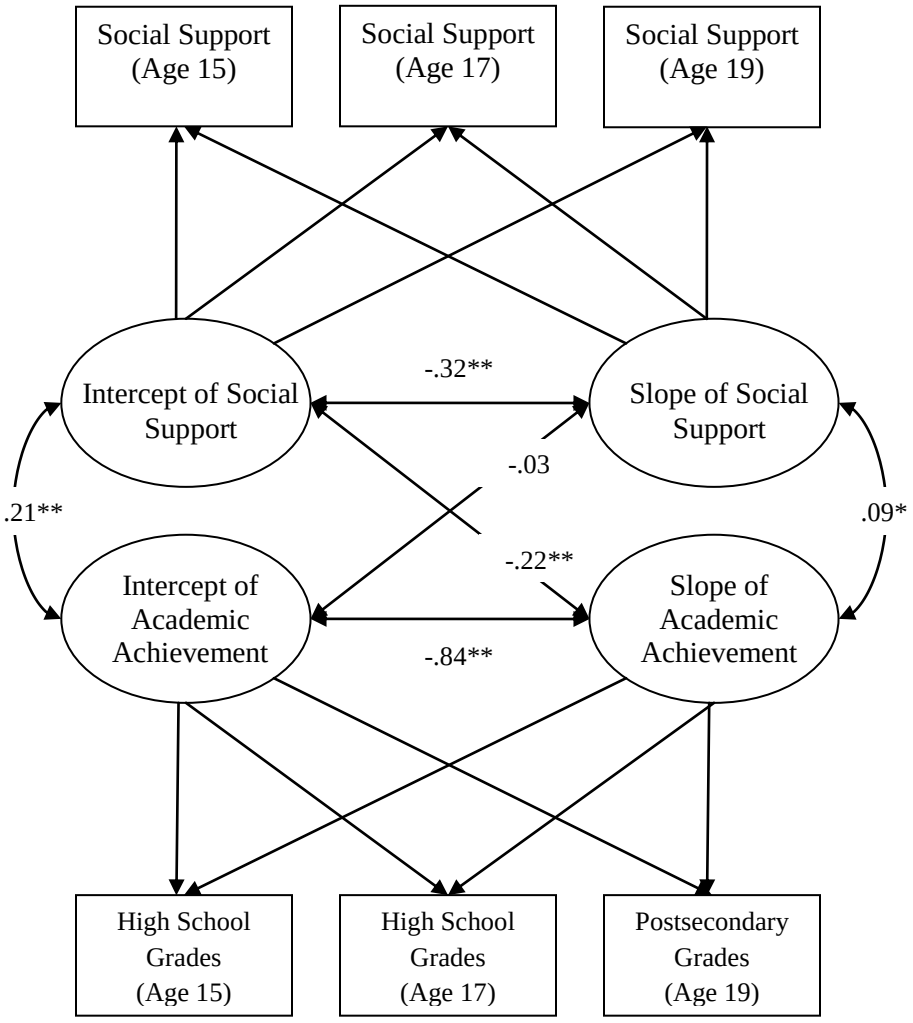

Figure 2. Bivariate linear growth curve analysis of social support and self-reported grades. Means, variances and errors are omitted from this figure. Rectangles represent measured variables. Ovals represent latent intercepts and slopes. Double-headed arrows represent correlations. Single headed arrows represent factor loadings. Factor loadings for intercepts were fixed to 1.0 to define the starting point of the growth trajectory. Factor loadings for slopes were fixed to 0, 1 and 2 to represent linear growth. All correlations represent standardized values. Sex and immigrant status were entered in as time-invariant covariates in this model, but are not depicted. * $p < .01$, ** $p < .001$

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Biography

Sean P. Mackinnon is a doctoral student in psychology at Dalhousie University, and he received his MA from Wilfrid Laurier University. Sean is interested in studying emerging adulthood as a distinct developmental stage, and is interested in longitudinal data analysis, personality, relationships, and psychological well-being.