



# Interdependence of depressive symptoms, school involvement, and academic performance between adolescent friends: A dyadic analysis

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**Background.** Friendships play an important role in the development of school involvement and academic performance during adolescence. This study examined the interdependence of depressive symptoms, school involvement, and academic performance between adolescent same-sex friends.

**Aims.** Using cross-sectional data, we examined whether the link between depressive symptoms and academic performance would be mediated by school involvement at the *intrapersonal* (actor) and *interpersonal* (partner) levels.

**Sample.** Data came from 155 pairs of same-sex adolescent friends (80 boys;  $M_{\text{age}} = 16.17$ ,  $SD = 0.44$ ). The actor–partner interdependence model was used to examine the dyadic data and mediation hypotheses.

**Results.** Mediated actor effects showed that adolescents who had more depressive symptoms reported lower academic performance, and such an association was mediated by their own and their friend's lower school involvement. Mediated partner effects showed that adolescents who had more depressive symptoms also had a friend with lower academic performance, and such an association was mediated by both individuals' lower school involvement.

**Conclusions.** This study provided evidence to support the broader interpersonal framework for understanding school involvement and academic performance. The current findings also have potential practical implications, especially for programmes targeted at addressing adolescents' school problems.

Adolescent friends often share similar attitudes, motivations, and behaviours towards school (Berndt, 1999; Véronneau & Dishion, 2011) and academic performance (Cook, Deng, & Morgano, 2007; Crosnoe, Cavanagh, & Elder, 2003; Véronneau, Vitaro, Brendgen, Dishion, & Tremblay, 2010; Wentzel, Barry, & Caldwell, 2004). Similar characteristics exhibited by close friends are termed as 'friendship homophily' in developmental psychology (Brechwald & Prinstein, 2011). There are two possible explanations for friendship homophily: *selection* and *socialization* processes. First, because friends with similar characteristics may provide a supportive environment that validates their own views and behaviour, adolescents may select or affiliate with friends

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who share common characteristics, including their academic beliefs and behaviours (Kandel, 1978). Second, because adolescents are attuned to and influenced by the attitudes and behaviours of friends (Brechwald & Prinstein, 2011), the transmission of academic behaviours and beliefs between friends is plausible through mutual influence and socialization (Jones, Audley-Piotrowski, & Kiefer, 2012; Rubin, Bukowski, & Parker, 2006). Through both processes, friendships during adolescence serve as an important formative context in which school involvement and academic performance are developed and maintained.

Although there is a large body of research on the association between friends' characteristics and adolescents' school adjustment (e.g., academic performance), most studies have focused on friends' externalizing problem behaviours (Véronneau & Dishion, 2011; Vitaro, Brendgen, & Wanner, 2005). For instance, studies found that having friends who engaged in aggression, substance abuse, and delinquent behaviours was associated with adolescents' own poorer academic performance (Patterson, Reid, & Dishion, 1992; Véronneau & Dishion, 2011; Vitaro *et al.*, 2005). Little is known, however, about how friends' internalizing behaviours, such as *depressive symptoms*, play a role in adolescents' school involvement and academic performance. We argued that this research question is important for two reasons. First, adolescence is a developmental period characterized by increased vulnerability to depressive symptoms (Nolen-Hoeksema & Girgus, 1994). Depressive symptoms are a risk factor for lower school involvement and poorer academic performance, which in turn may escalate depressive symptoms (Fröjd *et al.*, 2008; Humensky *et al.*, 2010; Shahar *et al.*, 2006; Verboom, Sijtsema, Verhulst, Penninx, & Ormel, 2014). Second, through selection and social processes, adolescent friends often have similar levels of depressive symptoms (Giletta *et al.*, 2011; Van Zalk, Kerr, Branje, Stattin, & Meeus, 2010). Whereas it has been well documented that adolescent friends' depressive symptoms are congruent, little is known whether adolescents' personal experiences of depressive symptoms would be associated with their friend's school involvement and academic performance. This study utilized a dyadic design and focused on investigating the interdependence of adolescent friends' (1) depressive symptoms and school involvement and (2) school involvement and academic performance. Furthermore, this study investigated how school involvement would mediate depressive symptoms and academic performance at both intrapersonal and interpersonal levels using the actor-partner interdependence model (APIM; Kenny, Kashy, & Cook, 2006).

## **Depressive symptoms and school involvement**

### *Intrapersonal association*

School involvement is a multifaceted construct defined as students' tendency to engage in academic and extracurricular activities, positive attitudes towards teachers and school, and willingness to demonstrate efforts in mastering academic skills (Fredricks, Blumenfeld, & Paris, 2004). Depressive symptoms often interfere with adolescents' development including their school involvement. Adolescents with more depressive symptoms show low interest and motivation to participate in various social activities, including academic-related activities (Garvik, Idsoe, & Bru, 2014; Kovacs & Goldstone, 1991; Roeser & Eccles, 2000). Indeed, research showed that adolescents with more depressive symptoms enjoyed school less, devoted less effort to academic performance, and cared less about school (Humensky *et al.*, 2010; Kingery, Erdley, & Marshall, 2011; Li & Lerner, 2011).

Furthermore, adolescents who experienced more depressive symptoms felt 'burnout' from school (e.g., exhaustion due to school demands, cynical about the purpose of schooling, detachment from school; Salmela-Aro, Savolainen, & Holopainen, 2009). Ironically, students who did not perform well in school, in turn, experienced more depressive symptoms (Verboom *et al.*, 2014).

#### *Interpersonal association*

Although the intrapersonal association between depressive symptoms and school involvement is well documented (Humensky *et al.*, 2010; Salmela-Aro *et al.*, 2009), the interdependence of depressive symptoms on school involvement between friends is unknown. According to *crossover effect*, negative emotion of one person may affect another close partner's behavioural and psychological outcomes (Bolger, DeLongis, Kessler, & Wethington, 1989; Thompson & Bolger, 1999). Thus, adolescents' depressive symptoms may influence their friend's school involvement, regardless of their friend's own depressive symptoms. Second, supportive peer interaction is a strong motivator for adolescents to be involved in school (Wentzel, 1998; Wentzel *et al.*, 2004). Having friends who suffer from more depressive symptoms may fail to provide adolescents with adequate social support and could demotivate them from involving in school. Together, it is likely that adolescents' depressive symptoms would be related to their friend's school involvement.

### **School involvement and academic performance**

#### *Intrapersonal association*

Researchers suggest that higher school involvement should promote better academic performance (Li & Lerner, 2011; Liem & Martin, 2011). Specifically, higher school involvement prevents adolescents from engaging in activities (e.g., delinquency, substance use) that increase their risks of academic failure (Li & Lerner, 2011). Furthermore, higher school involvement exposes adolescents to more learning opportunities beyond the classroom, which in turn lead to increased academic skills. Indeed, research has consistently found that higher behavioural involvement (e.g., completing homework, attendance) and emotional involvement (e.g., feeling attached to school, close to teachers) were predictive of better grades (Chase, Hilliard, Geldhof, Warren, & Lerner, 2014; Finn & Rock, 1997).

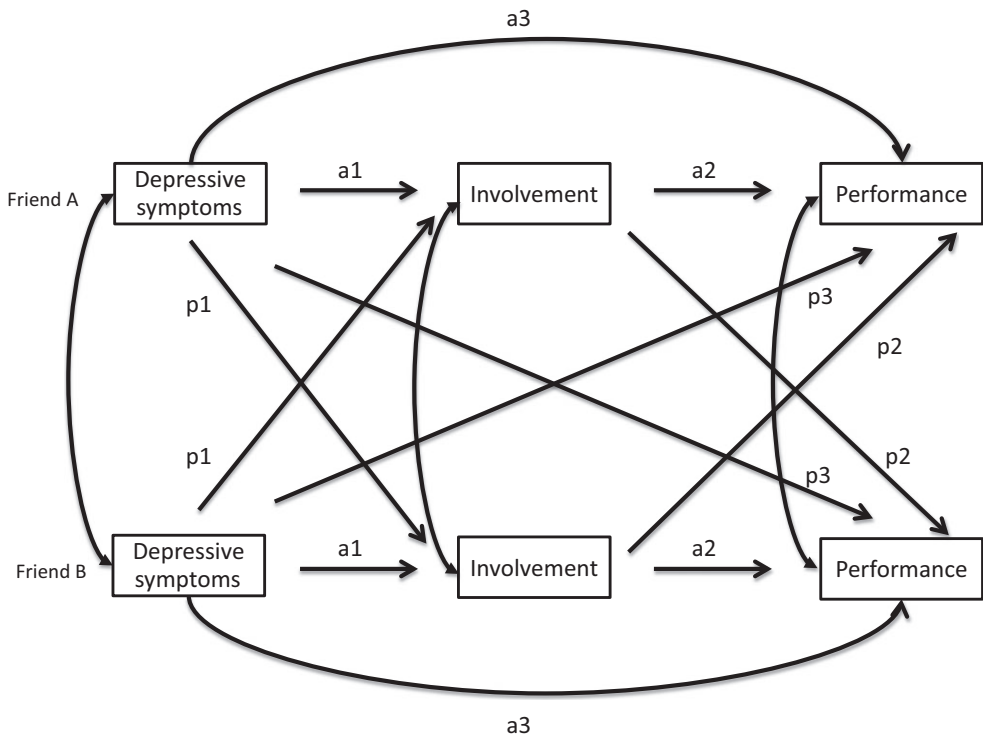
#### *Interpersonal association*

Lower school involvement is harmful not only to adolescents' own academic performance, but also to their close friends' academic performance (Véronneau & Dishion, 2011). For instance, having a friend who is more involved in school may provide adolescents with a learning environment that is more engaging and stimulating, which promotes better academic performance (Véronneau & Dishion, 2011). Furthermore, adolescents may have the privileges to access valuable academic support (e.g., efficient academic coping skills) from their friend who is highly involved in school (Véronneau & Dishion, 2011). Indeed, findings showed that friends' school involvement was related to adolescents' better academic performance (Altermatt & Pomerantz, 2003; Véronneau & Dishion, 2011).

**Actor–partner interdependence model**

*Direct actor and partner effects*

The intrapersonal and interpersonal associations between two friends’ depressive symptoms, school involvement, and academic performance could be examined within the framework of APIM (Kenny *et al.*, 2006). According to the APIM (see Figure 1), an outcome in a relationship is a function of the target person’s personal characteristic (*actor effect*) as well as the partner’s characteristic (*partner effect*). Based on previous research on depressive symptoms and school involvement (Garvik *et al.*, 2014), we hypothesized that adolescents’ more depressive symptoms would be associated with lower school involvement (*actor paths a1*). Furthermore, due to crossover effect (Bolger *et al.*, 1989), we hypothesized that more depressive symptoms in adolescents would be associated with their friend’s lower school involvement (*partner paths p1*). Furthermore, previous research showed that lower school involvement was not only harmful to adolescents’ own academic performance (Li & Lerner, 2011; Liem & Martin, 2011), but also to their close friend’s academic performance (Véronneau & Dishion, 2011). Therefore, we hypothesized that adolescents’ lower school involvement would be associated with their own lower academic performance (*actor paths a2*) and their friend’s lower academic performance (*partner paths p2*).



**Figure 1.** Theoretical representation of actor–partner interdependence model of friends’ depressive symptoms and academic performance mediated by school involvement at the actor and partner levels. Paths ‘a’ are actor effects and paths ‘p’ are partner effects. Estimates for Friend A and Friend B are identical because of the interchangeability of same-sex friends. Double-headed arrows are correlations.

### *Mediated actor and partner effects*

Integrating previous research on depressive symptoms, school involvement, and academic performance (Garvik *et al.*, 2014; Roeser & Eccles, 2000; Véronneau & Dishion, 2011), as well as research on crossover effects (Bolger *et al.*, 1989), we proposed an integrative model that suggests that the association between depressive symptoms and academic performance would be mediated by school involvement at the intrapersonal (actor) and interpersonal (partner) levels (see Figure 1).<sup>1</sup> A total of four possible mediational paths were proposed. First, we hypothesized that adolescents who have more depressive symptoms would be less involved in school, which in turn related to their own lower academic performance (*mediated actor effect 1*). Second, we hypothesized that adolescents who have more depressive symptoms would be less involved in school, which in turn related to their friend's lower academic performance (*mediated partner effect 1*). Third, we hypothesized that adolescents' depressive symptoms are associated with their friend's poorer academic performance through their friend's own lower school involvement (*mediated partner effect 2*). Fourth, because having a friend who is less involved in school would also be related to adolescents' own lower academic performance (Véronneau & Dishion, 2011), we hypothesized that the association between adolescents' depressive symptoms and their own academic performance would be mediated by their friend's lower school involvement (*mediated actor effect 2*). The proposed model in Figure 1 would be examined within the framework of structural equation model (SEM; Muthén & Muthén, 2010).

## **Method**

### ***Participants and procedure***

The current data came from a larger study on adolescents' families and friends. To recruit potential participants, recruitment letters were mailed to families with adolescents attending public schools in the North Texas region, USA. Families who were interested in the study contacted the researchers to schedule for a home visit. To be eligible for the study, the adolescents recruited a same-sex close friend to participate. During the home visit, informed consents were first obtained from the target adolescents, two parents, and same-sex friend. Informed consent from the recruited friend's parents was also obtained during the home visit. To protect their confidentiality, the target adolescents, two parents, and same-sex friend were separated into private areas of the home to complete a questionnaire package. All participants placed their questionnaires in a sealed envelope to ensure that others could not see their responses. The target adolescents and parents together received \$40, and the same-sex friend received \$20 for their participation.

For this study, only the target adolescents' and the same-sex friend's data were analysed. A total of 155 target adolescents (80 boys;  $M_{\text{age}} = 16.17$  years,  $SD = 0.44$ ) and their self-nominated best friend were included in this study. Most of the target adolescents (88.9%) were Caucasian, with 3.9% African American, 2.6% Hispanic, and 4.6% other. A majority of the target adolescents (62.1%) came from upper middle-class households (annual income >\$70,000) and lived with both biological parents (81%; 6.6% single parent, and 11% biological and step parent).

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<sup>1</sup> Although the proposed model suggests that depressive symptoms have an effect on academic performance through school involvement, these causal assumptions are completely theoretical. We would like to note that the current study's cross-sectional nature has prevented us from making causal inferences about these constructions, and such a limitation is discussed more extensively in the Discussion section.

## Measures

### *Depressive symptoms*

Adolescents' depressive symptoms were assessed with the Children's Depression Inventory (CDI; Kovacs, 1992). The original version of CDI contains 27 items capturing cognitive, affective, and behavioural symptoms of depression. For each item, participants were asked to select one of the three statements (scored from 0 to 2) that best described their depressive symptoms in the previous 2 weeks. One item on suicidal ideation was deleted from the original measure, as suggested by the IRB. An average score was computed across the remaining 26 items, with higher scores reflecting more depressive symptoms. In the current sample, Cronbach's alphas for adolescents and their friend were .84 and .87, respectively. Psychometric properties for the CDI have been demonstrated in previous research (e.g., Masip, Amador-Campos, Gómez-Benito, & Gándara, 2010; Saylor, Finch, Spirito, & Bennett, 1984).

### *School involvement*

Adolescents' school involvement was measured using a subscale from the Attitudes towards School Survey (Buhrmester, 1992, see Appendix). The school involvement subscale contains six items that measure adolescents' involvement in academic activities, positive reactions towards school, and willingness to demonstrate effort in mastering academic skills. One example item reads 'Fail to pay attention to what the teachers are saying'. Participants rated each item on a 5-point scale ranging from 1 (*not true*) to 5 (*extremely true*). An average score was then computed across the six items, with higher scores reflecting higher school involvement. In the current sample, Cronbach's alphas for adolescents and their friend were .74 and .68, respectively.

### *Academic performance*

Adolescents reported their academic performance in mathematics, English, and overall class performance (three items) based on their recollection of last report card. They reported their grades for each item on a 5-point scale ranging from 1 (*F*) to 5 (*A*). The three items were then averaged to form the academic performance subscale, with higher scores reflecting better grades. In the current sample, Cronbach's alphas for adolescents and their friend were .76 and .67, respectively. Validity of self-report assessment of academic performance has been demonstrated in previous research (Kuncel, Credé, & Thomas, 2005; Watson & Russell, 2015).

## Results

### *Testing distinguishability*

Dyadic data can be generally classified as either *distinguishable* dyads or *indistinguishable* dyads (Kenny *et al.*, 2006). For distinguishable dyads, there are clear roles that differentiate two members in a relationship (e.g., parent vs. child, husband vs. wife). In contrast, for indistinguishable dyads, there is no clear criterion that distinguishes the roles of two members. In this study, friend dyads could be distinguished by the roles of 'target adolescent' versus 'recruited friend'. Despite that, because adolescent friendships are egalitarian in nature, an explicit test of distinguishability of the same-sex friend dyads was conducted (Kenny *et al.*, 2006). Using structural equation modelling (SEM, Muthén &



Muthén, 2010), we first specified a baseline (saturated) model in which all means, variances, and covariances across two friends were allowed to vary. Then, we compared the baseline model with a constrained model in which all parameters across two friends were set to be equivalent. A chi-square difference test was then conducted to compare the baseline versus constrained model. A significant chi-square change would suggest that the dyads were distinguishable. When the equality constraints across two friends were imposed, the model fit change was not significant,  $\Delta\chi^2(12) = 19.07, p = .09$ . The non-significant model change showed that the roles of the friends were indeed indistinguishable (Kenny *et al.*, 2006). Therefore, all subsequent analyses were based on the constrained model.

### Descriptive analyses

Table 1 shows the means and standard deviations of this study's variables. Table 1 also shows the (1) within-individual correlations, (2) cross-partner correlations, and (3) intraclass correlations. Within-individual correlations showed that adolescents with more depressive symptoms also reported lower school involvement and lower academic performance. Furthermore, adolescents' lower school involvement was associated with lower academic performance. Cross-partner correlations revealed that adolescents with more depressive symptoms also had a friend who reported lower school involvement and lower academic performance. Also, adolescents' lower school involvement was associated with their friend's lower academic performance. Intraclass correlations showed that adolescents and their friend exhibited similar levels of school involvement and academic performance.

### Actor-partner interdependence model

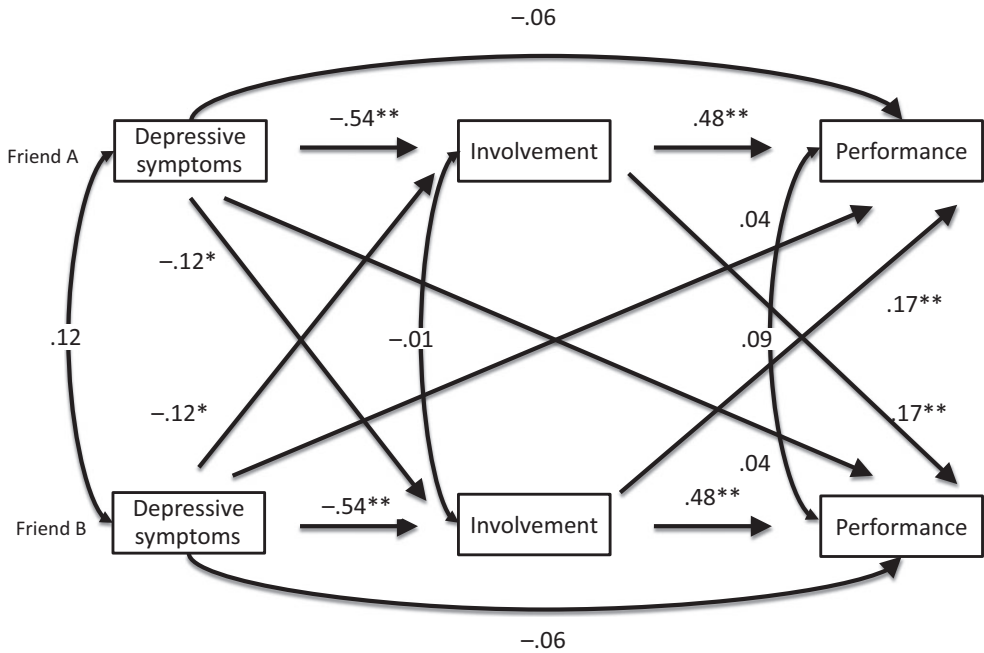
We specified the proposed APIM (see Figure 1) with a path model implemented in Mplus 6.11 (Muthén & Muthén, 2010). In addition to the direct actor and partner effects, this model also estimated the mediated actor and partner effects of school involvement between depressive symptoms and academic performance through indirect effects (e.g.,  $a_1*a_2$  and  $a_1*p_2$ ) and bias-corrected confidence intervals estimated by the *bootstrapping* procedures in Mplus 6.11 (Muthén & Muthén, 2010). Figure 2 shows the estimated path model and standardized path coefficients. The model fitted the data well, with  $\chi^2(12) = 19.07, p = .09, CFI = .97, TLI = .96, RMSEA = .06$ .

**Table 1.** Means, standard deviations, and correlations of study variables

	Depressive symptoms	School involvement	Academic performance
Depressive symptoms	.12	-.18**	-.15**
School involvement	-.55**	.16*	.24**
Academic performance	-.36**	.54**	.27**
M	1.35	3.50	4.19
SD	0.25	0.73	0.74

Note. Within-individual (below diagonal), between-individual (above diagonal), and intraclass (diagonal) correlations. Coefficients were computed with maximum-likelihood procedure in Mplus.

\* $p < .05$ ; \*\* $p < .01$ .



**Figure 2.** Empirical representation of the APIM. All path coefficients are standardized. Estimates for Friend A and Friend B are identical because the paths are constrained across friends. \* $p < .05$ ; \*\* $p < .01$ . APIM, actor-partner interdependence model.

#### Actor-level direct and mediation effects

Direct actor effects revealed that adolescents who had more depressive symptoms were less involved in school (*actor effect a1*). Adolescents' lower involvement in school, furthermore, was associated with their own lower academic performance (*actor effect a2*). Table 2 shows the mediation effects along with significance tests. Mediated actor effect showed that the association between adolescents' depressive symptoms and academic performance was mediated by their own school involvement (*mediated actor effect 1*). Specifically, adolescents who were more depressed also showed less school involvement, which in turn was related to lower academic performance. Furthermore, the link between adolescents' depressive symptoms and their own academic performance was also mediated by their friend's school involvement (*mediated actor effect 2*). Adolescents who had more depressive symptoms had a friend who showed less school involvement, which in turn was related to adolescents' lower academic performance.

#### Partner-level direct and mediation effects

Direct partner effects showed that adolescents' depressive symptoms were related to their friend's lower school involvement (*partner effect p1*). Adolescents' lower school involvement was also related to their friend's lower academic performance (*partner effect p2*). Mediated partner effect (see Table 2) showed that the association between adolescents' depressive symptoms and their friend's academic performance was mediated by their own school involvement (*mediated partner effect 1*). Specifically, adolescents who had more depressive symptoms showed less school involvement, which



**Table 2.** Indirect (mediation) effects from the actor–partner interdependence model with school involvement as mediator between depressive symptoms and academic performance

	Estimate	SE	95% CI
A-Depressive symptoms → A-Involvement → A-Performance	-.26**	0.04	-0.344 to -0.173
A-Depressive symptoms → P-Involvement → A-Performance	-.02*	0.01	-0.039 to -0.001
A-Depressive symptoms → A-Involvement → P-Performance	-.09**	0.03	-0.148 to -0.033
A-Depressive symptoms → P-Involvement → P-Performance	-.06*	0.03	-0.107 to -0.007

Note. A = actor, P = partner. Standard errors (SE) and bias-corrected confidence intervals were estimated based on bootstrap sampling of 5,000.

\* $p < .05$ ; \*\* $p < .01$ .

in turn was associated with their friend's lower academic performance. Furthermore, mediated partner effect showed that adolescents' depressive symptoms and their friend's academic performance were mediated by their friend's own school involvement (*mediated partner effect 2*). Specifically, adolescents who had more depressive symptoms had a friend who was less involved in school and, in turn, performed poorer in school.

## Discussion

The current study represents the first effort to examine the dyadic dynamics among depressive symptoms, school involvement, and academic performance. We examined the interdependence of adolescent friends' (1) depressive symptoms and school involvement and (2) school involvement and academic performance. Furthermore, we examined how school involvement would mediate depressive symptoms and academic performance at both intrapersonal (actor) and interpersonal (partner) levels. Overall, this study provided an initial support to the possible mediation pathways from depressive symptoms to academic performance through school involvement, at both actor and partner levels.

### **Depressive symptoms, school involvement, and academic performance: Intrapersonal analyses**

Previous research found that adolescents who suffered from more depressive symptoms showed lower school involvement, indicated by lower motivation to engage in academic-related activities and less positive connection with teachers and school (Li & Lerner, 2011). Furthermore, past research also showed that adolescents' lack of school involvement was related to lower academic performance (Liem & Martin, 2011). Previous research did not examine whether school involvement would serve as a mediator between depressive symptoms and academic performance. The current study integrated these lines of research and revealed that adolescents with more depressive symptoms were less involved in school, and their lower involvement in school was related to poorer academic performance (mediated actor effect 1). Viewing the current findings from a broader perspective, adolescents with more depressive symptoms may hold negative patterns of self-beliefs and tend to feel anxious about school performance (Quiroga, Janosz, Bisset, & Morin, 2013; Roeser & Eccles, 2000). As a result, they may feel helpless and less motivated to participate in academic-related activities (e.g., attendance, attention

in class), which could be harmful to their academic performance. Furthermore, adolescents with more depressive symptoms also have more difficulties (e.g., conflict) with their peer relationships in school (Rose *et al.*, 2011). Difficulties with peers, in turn, may reduce their interests in and attachment to school. Lower emotional involvement in school, not surprisingly, may also lead to poorer academic performance. Whereas the current study provided an initial support to the possible mediating role of school involvement between depressive symptoms and academic performance, we argued that the linkages among these constructs could be more complicated. Specifically, reciprocal influences of depressive symptoms and academic performance are plausible, and school involvement may serve as a mediator in these processes. These assumptions, however, require future research that employs a longitudinal design.

### ***Depressive symptoms, school involvement, and academic performance: Interpersonal analyses***

The most important feature of the current study was the dyadic approach. As expected, adolescents' school involvement was not only associated with their own depressive symptoms, but also their friend's depressive symptoms. In other words, adolescents who had a more depressed friend, regardless of their own depressive symptoms, were less likely to be involved in academic-related activities and enjoyed school less. There are two possible explanations for the current findings (Van Zalk *et al.*, 2010). First, from the homophilic selection perspective, adolescents who were more depressed might choose a friend who was less involved and performed poorly in school. Because friendships serve as an important source of support during adolescence (see Chow, Roelse, Buhrmester, & Underwood, 2011), it is possible that depressed adolescents would seek a friend who shared similar problems (e.g., failing a class) and that this may provide temporary remedies for their distress. Second, according to the socialization perspective, adolescents with a friend who suffered from depressive symptoms might also experience the negative affect through the process of crossover effect (Bolger *et al.*, 1989). It is possible that depressive symptoms and school problems may become interrelated across friends through dyadic interactions such as co-rumination (Rose, 2002; Rose, Carlson, & Waller, 2007). Specifically, friends may discuss their school-related worries and stress. Over time, both may exhibit similar levels of emotional problems, which could further contribute to similar levels of school-related problems. The current findings, however, were not able to disentangle between the selection and socialization processes. Nevertheless, the current study has provided an important foundation for future longitudinal research to examine these processes.

This study demonstrated that adolescents' academic performance was not solely associated with their own school involvement, but also their friend's school involvement. Specifically, findings showed that having a friend who was less involved in academic-related activities was related to adolescents' lower performance in school, even when their own involvement was controlled for. These results were consistent with previous research on young adolescents (Véronneau & Dishion, 2011), suggesting that adolescent friends may mutually reinforce each other's learning goals and academic coping skills through the interpersonal processes of social comparison and modelling. We argued that it is through these interpersonal processes that adolescents translated their friend's school involvement into their own academic achievement.

It is noteworthy that we also extended the traditional APIM by examining the mediation model within the context of dyadic friendships. Mediation effect showed that

more depressed adolescents were less involved in school; their lack of involvement in school, interestingly, was also related to their friend's lower academic performance (mediated partner effect 1). Furthermore, mediation effects showed that more depressed adolescents also had a friend who was less involved in school; their friend's lower involvement in school, in turn, was related to both individuals' lower academic performance (mediated actor effect 2, mediated partner effect 2). These findings suggest that adolescents might have internalized the depressive symptoms experienced by their friends and felt less motivated and positive towards school; these attitudes, in turn, were related to lower academic performance.

Although the current study was based on cross-sectional data, we argue that the current dyadic friendship model is especially important for understanding the stability and change in depressive symptoms, school involvement, and academic performance longitudinally. For instance, through socialization processes, two friends may experience parallel development of depressive symptoms. Parallel development in depressive symptoms, in turn, may account for both members' subsequent stability and change in school involvement and academic performance. Furthermore, the current model can be generalized to examining whether longitudinal changes in depressive symptoms and academic performance would be mediated by school involvement and how such a mediation process would manifest at the actor and partner levels.

### **Limitations and future directions**

Although we proposed the directional influences of depressive symptoms on school involvement and, in turn, academic performance, the current study's cross-sectional nature has precluded us from making a causal inference about these constructs. Several alternative explanations for the results are noteworthy. First, although the model assumes that depressive symptoms have an effect on adolescents' school maladjustment (e.g., poorer performance), it is certainly possible that having more problems in school may lead to more depressive symptoms. Second, although the model assumes that friends' depressive symptoms have an effect on adolescents' school involvement, it is possible that adolescents who are highly involved in school (e.g., participating in extracurricular activities) would encounter and befriend others with less depressive symptoms. Third, although the model assumes that friends' school involvement would influence adolescents' academic performance, it is equally possible that adolescents with poorer grades seek out friends who are less involved in school. Hence, future research may employ a longitudinal design to better clarify the directionality between depressive symptoms and school-related difficulties. For instance, a longitudinal design would permit the examination of the reciprocal and bidirectional associations between depressive symptoms and academic performance (Salmela-Aro *et al.*, 2009) in the context of dyadic friendships. Furthermore, it is possible to employ a latent growth curves approach (McArdle, 2009) to document the parallel change of depressive symptoms, school involvement, and academic performance between two friends over the course of adolescence. Alternatively, researchers may employ an experimental approach to investigate the effect of depressive symptoms on school-related difficulties in the context of friendships. One experimental procedure proposed by Byrd-Craven, Granger, and Auer (2011) is particularly relevant. Specifically, negative affect may be induced by asking friend dyads to discuss about their personal stress. This 'problem-talk' group may then be compared to the control group (friend dyads who engage in a neutral conversation) in terms of their performance in various cognitive or learning tasks. This experimental approach would

provide stronger evidence for the causal effect of depressive mood on school outcomes in friendships. Nevertheless, the current study has provided important evidence to support the theoretical model, which warrants for future longitudinal or experimental research.

Second, all variables in the current study were based on adolescents' self-reports. As mentioned earlier, adolescents who had more depressive symptoms might have seen their world through a negative lens and hence reported biased evaluation of their school involvement and performance. Therefore, it is important for future research to capture adolescents' actual grade performance through report cards. Alternatively, adolescents' depressive symptoms and school involvement could be measured through other report including parents or teachers. We argued that having a multiple-informant design is crucial to addressing the issue of self-report biases. Furthermore, an experimental induction of depressive mood and its effect on learning would be crucial in remedying the shared method variance problem.

Third, the current sample was rather homogenous in terms of its demographic background. Specifically, the findings were limited to middle-class adolescents and the results may not be generalized to populations such as adolescents with lower socioeconomic status (SES). For instance, past research showed that low SES was a risk factor for adolescents' lower academic performance, but such an association was buffered by higher levels of social support (Malecki & Demaray, 2006). Because close friendships are important sources of social support (Chow *et al.*, 2011), it would be important to investigate whether having a depressed friend, who may no longer provide the therapeutic function of social support, would escalate the risk of low SES on academic performance. Furthermore, we focused on adolescents' depressive symptoms rather than on clinical diagnoses. It is important for future research to examine whether the crossover effects of friends' depressive symptoms on adolescents' school involvement are especially profound in the clinical population compared to non-clinical population. It is also crucial to acknowledge that friend dyads in the current study were limited to same-sex friends. Although theory suggests that same-sex friendships play a crucial role in adolescents' psychological development (Sullivan, 1953), more recent theory and research suggest that opposite-sex friends gradually emerge as important social ties, especially during middle and late adolescence (Buhrmester & Furman, 1986). Therefore, it would be fruitful for future research to apply the current model to both same-sex and opposite-sex friends, examining their influence on adolescents' school involvement and academic performance, especially on comparing their relative predictive power.

### **Conclusions**

The current research provided evidence to support the broader interpersonal framework for understanding school involvement and academic performance. The current findings also have practical implications, especially for programmes targeted at addressing adolescents' school problems. The current study showed that school problems may develop within adolescents' dyadic friendships through the transmission of depressive symptoms between friends. Therefore, it is important for interventions to focus on friend dyads' psychological distress instead of just one individual's when attempting to remediate the effect of depressive symptoms on school involvement and academic performance. Furthermore, because crossover effect often occurs and emerges in the context of emotion-focused conversation between friends, clinical interventions may focus on helping adolescent friends to develop skills in regulating their negative emotion through constructive social support conversations (e.g., problem focused) instead of

co-rumination (Rose, 2002). This approach may be useful in addressing the crossover effect of depressive symptoms in friendships. In summary, the current study's findings increased the understanding of adolescents' depressive symptoms, school involvement, and academic performance in the context of dyadic friendships.

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## References

- Altermatt, E. R., & Pomerantz, E. M. (2003). The development of competence-related and motivational beliefs: An investigation of similarity and influence among friends. *Journal of Educational Psychology, 95*(1), 111–123. doi:10.1037/0022-0663.95.1.111
- Berndt, T. J. (1999). Friends' influence on students' adjustment to school. *Educational Psychologist, 34*(1), 15–28. doi:10.1207/s15326985ep3401\_2
- Bolger, N., DeLongis, A., Kessler, R. C., & Wethington, E. (1989). The contagion of stress across multiple roles. *Journal of Marriage and the Family, 51*(1), 175–183. doi:10.2307/352378
- Brechwald, W. A., & Prinstein, M. J. (2011). Beyond homophily: A decade of advances in understanding peer influence processes. *Journal of Research on Adolescence, 21*(1), 166–179. doi:10.1111/j.1532-7795.2010.00721.x
- Buhrmester, D. (1992). *Attitudes towards school survey* (Unpublished Questionnaire). University of Texas at Dallas, Richardson, TX.
- Buhrmester, D., & Furman, W. (1986). The changing function of friends in childhood. A Neo-Sullivanian perspective. In V. Derlega & B. Winstead (Eds.), *Friendship and social interaction* (pp. 41–62). New York, NY: Springer-Verlag.
- Byrd-Craven, J., Granger, D. A., & Auer, B. J. (2011). Stress reactivity to co-rumination in young women's friendships: Cortisol, alpha-amylase, and negative affect focus. *Journal of Social and Personal Relationships, 28*, 469–487. doi:10.1177/0265407510382319
- Chase, P. A., Hilliard, L. J., Geldhof, G. J., Warren, D. J., & Lerner, R. M. (2014). Academic achievement in the high school years: The changing role of school engagement. *Journal of Youth and Adolescence, 43*, 884–896. doi:10.1007/s10964-013-0085-4
- Chow, C., Roelse, H. B., Buhrmester, D., & Underwood, M. K. (2011). Transformations in friend relationships across the transition into adulthood. In B. Laursen & W. A. Collins (Eds.), *Relationship pathways: From adolescence to young adulthood* (pp. 91–113). Thousand Oaks, CA: Sage.
- Cook, T. D., Deng, Y., & Morgano, E. (2007). Friendship influences during early adolescence: The special role of friends' grade point average. *Journal of Research on Adolescence, 17*, 325–356. doi:10.1111/j.1532-7795.2007.00525.x
- Crosnoe, R., Cavanagh, S., & Elder, G. R. (2003). Adolescent friendships as academic resources: The intersection of friendship, race, and school disadvantage. *Sociological Perspectives, 46*, 331–352. doi:10.1525/sop.2003.46.3.331
- Finn, J. D., & Rock, D. A. (1997). Academic success among students at risk for school failure. *Journal of Applied Psychology, 82*, 221–234. doi:10.1037/0021-9010.82.2.221
- Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59–109. doi:10.3102/00346543074001059
- Fröjd, S. A., Nissinen, E. S., Pelkonen, M. U., Marttunen, M. J., Koivisto, A. M., & Kaltiala-Heino, R. (2008). Depression and school performance in middle adolescent boys and girls. *Journal of Adolescence, 31*, 485–498. doi:10.1016/j.adolescence.2007.08.006



- Garvik, M., Idsoe, T., & Bru, E. (2014). Depression and school engagement among Norwegian upper secondary vocational school students. *Scandinavian Journal of Educational Research*, *58*, 592–608. doi:10.1080/00313831.2013.798835
- Giletta, M., Scholte, R. J., Burk, W. J., Engels, R. E., Larsen, J. K., Prinstein, M. J., & Ciairano, S. (2011). Similarity in depressive symptoms in adolescents' friendship dyads: Selection or socialization? *Developmental Psychology*, *47*, 1804–1814. doi:10.1037/a0023872
- Humensky, J., Kuwabara, S. A., Fogel, J., Wells, C., Goodwin, B., & Van Voorhees, B. W. (2010). Adolescents with depressive symptoms and their challenges with learning in school. *The Journal of School Nursing*, *26*, 377–392. doi:10.1177/1059840510376515
- Jones, M. H., Audley-Piotrowski, S. R., & Kiefer, S. M. (2012). Relationships among adolescents' perceptions of friends' behaviors, academic self-concept, and math performance. *Journal of Educational Psychology*, *104*(1), 19–31. doi:10.1037/a0025596
- Kandel, D. B. (1978). Homophily, selection, and socialization in adolescent friendships. *American Journal of Sociology*, *84*, 427–436. doi:10.1086/226792
- Kenny, D. A., Kashy, D. A., & Cook, W. L. (2006). *Dyadic data analysis*. New York, NY: Guilford Press.
- Kingery, J. N., Erdley, C. A., & Marshall, K. C. (2011). Peer acceptance and friendship as predictors of early adolescents' adjustment across the middle school transition. *Merrill-Palmer Quarterly*, *57*, 215–243. doi:10.1353/mpq.2011.0012
- Kovacs, M. (1992). *Children depression inventory (CDI) manual*. Toronto: Multi-Health Systems.
- Kovacs, M., & Goldstone, D. (1991). Cognitive and social cognitive development of depressed children and adolescents. *Journal for the American Academy of Child and Adolescent Psychiatry*, *30*, 388–392. doi:10.1097/00004583-199105000-00006
- Kuncel, N. R., Credé, M., & Thomas, L. L. (2005). The validity of self-reported grade point averages, class ranks, and test scores: A meta-analysis and review of the literature. *Review of Educational Research*, *75*(1), 63–82. doi:10.3102/00346543075001063
- Li, Y., & Lerner, R. M. (2011). Trajectories of school engagement during adolescence: Implications for grades, depression, delinquency, and substance use. *Developmental Psychology*, *47*(1), 233. doi:10.1037/a0021307
- Liem, G. A. D., & Martin, A. J. (2011). Peer relationships and adolescents' academic and non-academic outcomes: Same-sex and opposite-sex peer effects and the mediating role of school engagement. *British Journal of Educational Psychology*, *81*, 183–206. doi:10.1111/j.2044-8279.2010.02013.x
- Malecki, C., & Demaray, M. (2006). Social support as a buffer in the relationship between socioeconomic status and academic performance. *School Psychology Quarterly*, *21*, 375–395. doi:10.1037/h0084129
- Masip, A. F., Amador-Campos, J. A., Gómez-Benito, J., & Gándara, V. D. B. (2010). Psychometric properties of the Children's Depression Inventory in community and clinical sample. *The Spanish Journal of Psychology*, *13*, 990–999. doi:10.1017/S1138741600002638
- McArdle, J. J. (2009). Latent variable modeling of differences and changes with longitudinal data. *Annual Review of Psychology*, *60*, 577–605. doi:10.1146/annurev.psych.60.110707.163612
- Muthén, L. K., & Muthén, B. O. (2010). *Mplus user's guide*. Los Angeles, CA: Author.
- Nolen-Hoeksema, S., & Girgus, J. S. (1994). The emergence of gender differences in depression during adolescence. *Psychological Bulletin*, *115*, 424. doi:10.1037/0033-2909.115.3.424
- Patterson, G. R., Reid, J., & Dishion, T. (1992). *Antisocial boys*. Eugene, OR: Castalia.
- Quiroga, C. V., Janosz, M., Bisset, S., & Morin, A. J. S. (2013). Early adolescent depression symptoms and school dropout: Mediating processes involving self-reported academic competence and achievement. *Journal of Educational Psychology*, *105*(2), 552–560. doi:10.1037/a0031524
- Roeser, R. W., & Eccles, J. S. (2000). Schooling and mental health. In A. J. Sameroff, M. Lewis, & S. M. Miller (Eds.), *Handbook of developmental psychopathology* (2nd ed.). (pp. 135–156). New York: Kluwer Academic/Plenum.
- Rose, A. J. (2002). Co-rumination in the friendships of girls and boys. *Child Development*, *73*, 1830–1843. doi:10.1111/1467-8624.00509



- Rose, A. J., Carlson, W., Luebke, A. M., Schwartz-Mette, R. A., Smith, R. R., & Swenson, L. P. (2011). Predicting difficulties in youth's friendships: Are anxiety symptoms as damaging as depressive symptoms? *Merrill-Palmer Quarterly*, *57*, 244–262. doi:10.1353/mpq.2011.0013
- Rose, A. J., Carlson, W., & Waller, E. M. (2007). Prospective associations of co-rumination with friendship and emotional adjustment: Considering the socioemotional trade-offs of co-rumination. *Developmental Psychology*, *43*, 1019–1031. doi:10.1037/0012-1649.43.4.1019
- Rubin, K. H., Bukowski, W., & Parker, J. (2006). Peer interactions, relationships, and groups. In N. Eisenberg (Ed.), *Handbook of child psychology: Social, emotional, and personality development* (pp. 571–645). New York, NY: Wiley.
- Salmela-Aro, K., Savolainen, H., & Holopainen, L. (2009). Depressive symptoms and school burnout during adolescence: Evidence from two cross-lagged longitudinal studies. *Journal of Youth and Adolescence*, *38*, 1316–1327. doi:10.1007/s10964-008-9334-3
- Saylor, C. F., Finch, A. J., Spirito, A., & Bennett, B. (1984). The children's depression inventory: A systematic evaluation of psychometric properties. *Journal of Consulting and Clinical Psychology*, *52*, 955–967. doi:10.1037/0022-006X.52.6.955
- Shahar, G., Henrich, C. C., Winokur, A., Blatt, S. J., Kuperminc, G. P., & Leadbeater, B. J. (2006). Self-criticism and depressive symptomatology interact to predict middle school academic achievement. *Journal of Clinical Psychology*, *62*(1), 147–155. doi:10.1002/jclp.20210
- Sullivan, H. S. (1953). *The interpersonal theory of psychiatry*. New York, NY: Norton.
- Thompson, A., & Bolger, N. (1999). Emotional transmission in couples under stress. *Journal of Marriage and the Family*, *61*(1), 38–48. doi:10.2307/353881
- Van Zalk, M. H. W., Kerr, M., Branje, S. J. T., Stattin, H., & Meeus, W. H. J. (2010). It takes three: Selection, influence, and de-selection processes of depression in adolescent friendship networks. *Developmental Psychology*, *46*, 927–938. doi:10.1037/a0019661
- Verboom, C. E., Sijtsema, J. J., Verhulst, F. C., Penninx, B. W., & Ormel, J. (2014). Longitudinal associations between depressive problems, academic performance, and social functioning in adolescent boys and girls. *Developmental Psychology*, *50*, 247–257. doi:10.1037/a0032547
- Véronneau, M. H., & Dishion, T. J. (2011). Middle school friendships and academic achievement in early adolescence: A longitudinal analysis. *The Journal of Early Adolescence*, *31*(1), 99–124. doi:10.1177/0272431610384485
- Véronneau, M., Vitaro, F., Brendgen, M., Dishion, T. J., & Tremblay, R. E. (2010). Transactional analysis of the reciprocal links between peer experiences and academic achievement from middle childhood to early adolescence. *Developmental Psychology*, *46*, 773–790. doi:10.1037/a0019816
- Vitaro, F., Brendgen, M., & Wanner, B. (2005). Patterns of affiliation with delinquent friends during late childhood and early adolescence: Correlates and consequences. *Social Development*, *14*(1), 82–108. doi:10.1111/j.1467-9507.2005.00292.x
- Watson, R. J., & Russell, S. T. (2015). Disengaged or bookworm: Academics, mental health, and success for sexual minority youth. *Journal of Research on Adolescence*. Advance online publication. doi:10.1111/jora.12178
- Wentzel, K. R. (1998). Social relationships and motivation in middle school: The role of parents, teachers, and peers. *Journal of Educational Psychology*, *90*, 202–209. doi:10.1037/0022-0663.90.2.202
- Wentzel, K. R., Barry, C., & Caldwell, K. A. (2004). Friendships in middle school: Influences on motivation and school adjustment. *Journal of Educational Psychology*, *96*, 195–203. doi:10.1037/0022-0663.96.2.195

### Appendix : Factor loadings for adolescents' self- and friend-report of school involvement items

	Factor loadings	
	Self-report	Friend report
1. Seem to enjoy school	.769	.746
2. Take part in class discussions	.346	.321
3. Fail to pay attention to what the teachers are saying (negatively scored)	.735	.610
4. Care about getting the best grades they can	.734	.719
5. Complete homework assignments	.783	.732
6. Seem to hate schoolwork (negatively scored)	.573	.575

*Note.* Although Item 2's loading was lower than others, considering its face validity, we decided to keep this item in the scale.