



Representations of relatedness with parents and friends and autonomous academic motivation during the late adolescence–early adulthood period: Reciprocal or unidirectional effects?

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Background. The literature on the determinants of academic motivation indicates that social and affective processes connected to students' interpersonal relationships are central elements in understanding students' academic motivation and other school-related outcomes.

Aims. The aim of this study was to answer the following questions: Does autonomous motivation drive representations of relatedness, do representations of relatedness drive autonomous motivation, or are these constructs reciprocally related over time?

Sample. The sample consists of 834 adolescents aged 18 years ($SD = 1.88$) who participated in a 3-year longitudinal study.

Results. Results from the structural equation models provided good support for the effect of representations of relatedness with parents on autonomous academic motivation but no convincing support for the effect of motivation on representations of relatedness with parents. In addition, no significant effect in either direction was found between representations of relatedness with friends and autonomous academic motivation.

Conclusion. It might be important to inform parents that they may still have an influence on their adolescent's representations of relatedness and subsequently on his/her autonomous academic motivation even during the late adolescence–early adulthood period, a period when some parents may be tempted to believe that they can do little to motivate their offspring.

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Motivation is recognized as a key determinant of school adaptation. For example, some studies have shown that motivation is associated with persistence (Vallerand, Fortier, & Guay, 1997). Consequently, researchers have tried to identify and understand what triggers motivation in the educational context. The literature on the determinants of academic motivation indicates that social and affective processes connected to students' interpersonal relationships are central elements in understanding students' academic motivation and other school-related outcomes (Connell & Wellborn, 1991). For example, Grolnick and Apostoleris (2002) suggest that because parents are the primary socializers of students, it is expected that the quality of relationships students have with their parents fosters their motivation towards academic work. Similarly, Pianta (1999) argues that relationships with significant adults and peers are an essential part of the classroom experience and a potent resource for understanding why the students thrive or fail to thrive at school.

In exploring the literature on the relations between the academic motivation and the quality of relationships, we observed that few studies have verified how these concepts are interrelated. Most motivational studies conducted until now have hypothesized that students' academic motivation is influenced by their perceptions of significant others (Vallerand *et al.*, 1997), while the alternative perspective, which posits that students' motivational beliefs may affect perceptions of the quality of their relationships with others, has rarely been tested. Specifically, this latter perspective suggests that adolescents who fully endorse school values may perceive the quality of relationships with significant others to be higher than students who reject these values. This perspective has been echoed, albeit indirectly, in some models positing that characteristics of the student are important features embedded in the adult-student relationship (Pianta, 1999).

The purpose of the present study was thus to test potential causal effects among *representations of relatedness* (i.e. a specific component of the quality of relationships) with parents and friends and a specific indicator of academic motivation, namely autonomous academic motivation. In the following sections, we will focus on (a) conceptualizing autonomous academic motivation; (b) defining the representations of relatedness construct; (c) outlining the importance of relatedness with parents and friends during the late adolescence-early adulthood period; (d) explaining the rationale underlying the relation between the autonomous academic motivation and the representations of relatedness.

Autonomous academic motivation

The construct of motivation has been operationalized in relation to various theoretical approaches. However, few approaches have shed light on how adolescents integrate school activities into their own set of values and how this integration facilitates learning and achievement. A useful theoretical framework for understanding the process of integration of school-related activities is the self-determination theory (SDT) (Deci & Ryan, 1985). SDT proposes that there are different types of motivation, reflecting different levels of self-determination. *Intrinsic motivation* reflects the highest degree of self-determination. It refers to engaging in an activity for its own sake and for the experience of pleasure and satisfaction derived from participation. Of course, not all behaviours are intrinsically motivated. Some of them are driven by extrinsic motivations. *Extrinsic motivation* refers to engaging in an activity as a means to an end rather than for its intrinsic qualities. However, different types of extrinsic motivation exist, which differ in their underlying level of self-determination or autonomy. Ordered from low to high,

in terms of levels of self-determination, the different types of extrinsic motivation are: external regulation; introjected regulation; identified regulation; and integrated regulation. *External regulation* refers to behaviours that are not self-determined because they are regulated through external means such as rewards and constraints. *Introjected regulation* refers to behaviours that are partly internalized by the person. For example, individuals can act in order to rid themselves of guilt, lessen anxiety, or maintain a positive image of themselves. *Identified regulation* refers to behaviours that are performed by choice because the individual judges them to be important. For example, a student may not like college but may decide to go because he/she feels that a college diploma is important in order to enter the job market in a field that he/she likes. According to SDT, an external source of motivation can be progressively transformed into identified regulation (personally valued) through the process of internalization. When a behaviour that is externally motivated initially becomes regulated by identification, this behaviour becomes as effective as intrinsically motivated behaviours in terms of producing positive outcomes. *Integrated regulation* occurs when identified regulations are into congruence with other values and needs. However, this form of regulation is more relevant for individuals with formed identities and not to older adolescents and emerging adults who are the focus of the present research. For this reason, integrated regulation will not be evaluated in this study.

An additional concept posited by SDT is amotivation. *Amotivation* pertains to the lack of intentionality and therefore refers to the relative absence of motivation (whether intrinsic or extrinsic). Amotivated individuals experience feelings of incompetence and expectancies of uncontrollability. Recently, Shahar, Henrich, Blatt, Ryan, & Little (2003) have argued that the distinction between autonomous and controlled motivation is more important than the distinction between intrinsic and extrinsic motivation. In the present study, we adhered to this perspective by grouping the various motivational constructs into three broad categories, namely, *autonomous motivation* (i.e. motivation that is intrinsic and/or identified), *controlled regulation* (i.e. motivation that is regulated by introjected and/or external regulations), and *amotivation*. Using these broad categories of motivation, rather than referring to each type of motivation, offers the possibility to test more parsimonious models while taking into account the distinction between the autonomous and controlled forms of regulation.

Representations of relatedness

According to Ryan and Deci (2002): 'Relatedness refers to feeling connected to others, to caring for and being cared for by those others, to having a sense of belongingness both with other individuals and with one's community (p. 7)'. The relatedness construct is thus considered as an internal 'representation' of relationships with caregivers or significant others. These representations of relatedness from the perspective of the students are of primary interest in the present study because previous research has repeatedly shown that these representations are the important organizers of psychosocial development. For example, SDT (Deci & Ryan, 1991) posits that relatedness is a basic psychological need that is an essential prerequisite for the initiation of autonomously motivated behaviour and psychological growth. This is especially important in the case where students are not intrinsically motivated by college but need, nevertheless, to endorse school values. The internalization of external demands is more likely to occur when students feel connected to significant others (Deci & Ryan, 1991). By contrast, when students feel detached from others, these external demands have less chance of

being integrated into the self. SDT thus hypothesizes that representations of relatedness with significant others are positively related to autonomous motivation but negatively related to controlled motivation and amotivation.

The importance of relatedness with parents and peers during the late adolescence–early adulthood period

Considerable research supports the idea that parents are important in fostering autonomous academic motivation (Grolnick & Apostoleris, 2002) or achievement (Brown, Mounts, Lamborn, & Steinberg, 1993). However, perhaps one of the most relevant questions is the relative strength of the influence of friends compared to that of parents. Indeed, some developmental psychologists recognize that friends have a strong influence on an individual's development and social adjustment (Hartup & Stevens, 1997). For example, Guay, Boivin, and Hodges (1999) have shown, among a sample of elementary school children, that social preference assessed via a sociometric procedure was related to higher representations of relatedness with peers which in-turn was associated with higher motivational beliefs. In addition, it has been shown that deviant friendships in adolescence explain low levels of school achievement over and beyond parental SES (Véronneau, Vitaro, Pedersen, & Tremblay, 2008) and that adolescents' peer group characteristics predict school engagement over and beyond parents and teachers involvement (Kindermann, 2007).

However, few studies have directly contrasted representations of relatedness with parents and those with friends. Indeed, most of the previous studies (Brown *et al.*, 1993, Kindermann, 2007; Véronneau *et al.*, in press) rely on friends/peers' characteristics and not on the levels of relatedness with friends. Ryan, Stiller, and Lynch (1994) reported, in a sample of adolescents, that representations of relatedness with friends are not associated with autonomous academic motivation whereas those with parents and teachers are. However, it is important to note that Ryan *et al.*'s study was conducted on samples of early adolescents. Far less empirical evidence is available on whether parents or friends are more important for predicting autonomous academic motivation in the late adolescence–early adulthood period. This is indeed unfortunate because many researchers and practitioners alike argue that during the adolescent period, young people are more inclined to share their personal thoughts with close friends than with their parents (Harter, 1999). Indeed, teenagers spend 29% of their waking hours with friends (Hartup & Stevens, 1997). Consequently, they may be more prone to talk about their scholastic experiences with close friends than with their parents. The context of friendships may therefore offer some support in coping with anxiety-provoking developmental challenges that confront students. In other words, in late adolescence, representations of relatedness with friends could be more important for predicting autonomous academic motivation than representations of relatedness with parents. Nevertheless, Harter argues that although the influence of friends and peers increases in adolescence and early adulthood, the effects of parents remain high and stable from childhood until the early adulthood period.

Taken as a whole, previous studies are relatively unclear on the issue of whether parents' relatedness are more important than friends' relatedness in predicting motivation in the late adolescence–early adulthood period. Moreover, whereas the importance of representations of relatedness are widely recognized as one of the major determinants of motivation, there is limited research testing the causal ordering of motivation and representations of relatedness using appropriate longitudinal data and structural equation models.

Representations of relatedness and autonomous academic motivation: Why both constructs are likely to be related in a reciprocal way

It is relatively clear from the literature cited above that most researchers endorse the point of view that representations of relatedness with parents and friends (or similar constructs) 'predict' autonomous motivation. However, as we argued earlier, it is also possible that representations of relatedness with significant others are reinforced by the fact that students are autonomously motivated. Indeed, adolescents and young adults are not passive recipients of the social context. They are active agents in the social context, evoking responses from both the parents and the friends. These responses may elicit behaviours from others that in-turn modify the students' representations of relatedness with significant others (Pianta, 1999). For example, a student may enjoy college educational activities and consider them to be important (i.e. autonomous motivation), which subsequently affects his/her behaviours (e.g. seeking support from friends, studying more at home). In turn, his/her own behaviours elicit behaviours from friends (e.g. friends giving support) and parents (e.g. parents giving positive feedback), thereby subsequently leading to better representations of relatedness with these persons. Indeed, as we argued earlier, representations of relatedness are hypothesized to be updated and modified as a result of interactions with significant others.

Despite the fact that, to date, research on the reciprocal effects perspective has been scarce, some studies nevertheless suggest that this perspective may be defensible (Pelletier, Séguin-Lévesque, & Legault, 2002). In addition, to the best of our knowledge, SDT would not argue that the potential effect of representations of relatedness on motivation is untenable. Indeed, this theory endorses a reciprocal point of view where growth is viewed as a product of the exchange between the person and his/her social environment over time.

Overview of the present study

The purpose of the present study was to test causal ordering among representations of relatedness (parents and friends) and the different types of motivation described above among a sample of 834 college students. Specifically, we investigated, using a structural equation reciprocal effects model involving three waves of data, how representations of relatedness (parents and friends) and academic motivation influence each other (see Figure 1). The present study extends previous work on the topic with regard to two important aspects. First, most previous studies are cross-sectional and thus provide a weak test for a reciprocal effects model. Second, the present study could provide insightful information for theory. For example, findings showing that prior academic motivation affects representations of relatedness whereas prior representations of relatedness do not affect academic motivation could present a challenge to researchers who endorse the theory that representations of relatedness are antecedents of academic motivation. Such a finding might indicate that the motivational characteristics of students are much more important in defining the quality of their relationships in this particular life period.

Method

Participants and procedure

In September 2000 (Time 1), 2,300 college participants were contacted in college classrooms and asked to complete a questionnaire at home (the total population of college students is approximately 190,000). In Quebec, students must attend college

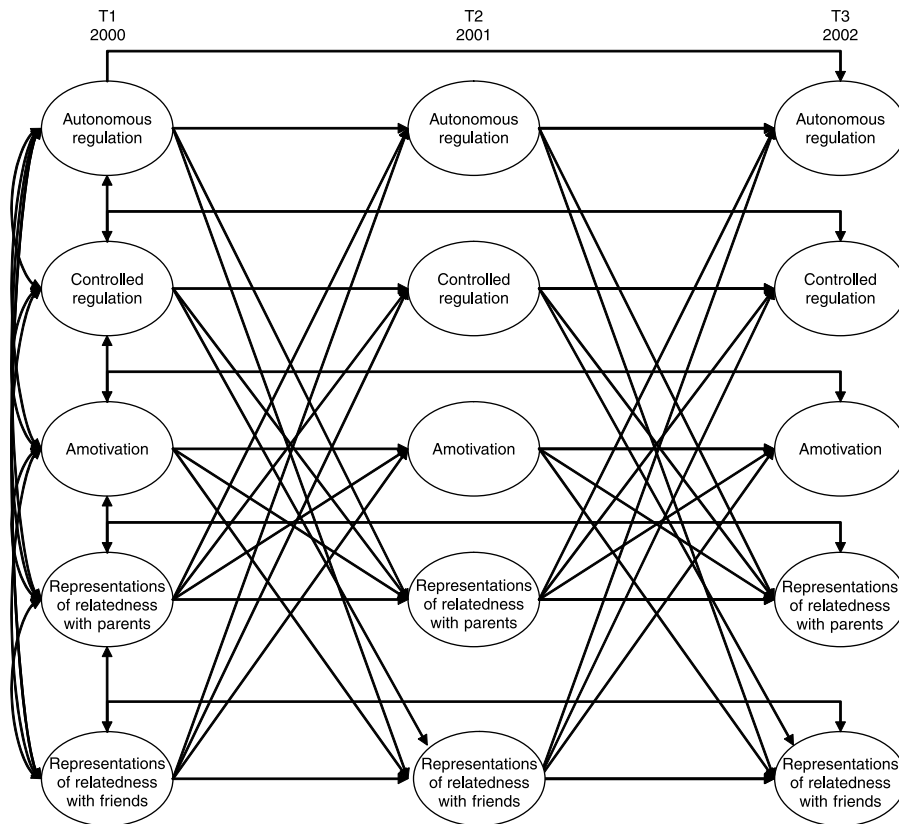


Figure 1. The hypothesized model to be tested.

before entering university. The questionnaire was handed out along with a pre-stamped envelope addressed to the University. A total of 834 students agreed to participate in the present investigation (36%). Of the 834 participants, there were 236 males and 581 females (17 participants did not specify their gender). Participants' mean age was 17.7 ($SD = 1.88$) years and 97% of them were born in the province of Quebec. In total, 29% of the participants had divorced parents. The average family income was between C\$30,000 and C\$40,000. In September 2001 (T2), a questionnaire was sent out to the same 834 participants; 380 participants returned their questionnaires (46%). In September 2002 (T3), the same questionnaire was once again sent out to the 834 participants; 325 participants returned their surveys (39%). However, only 224 participants provided complete data on all three occasions (27%). In the statistical analyses section, we address the problem of missing data.

Measures

The academic motivation scale

The French version of the Academic Motivation Scale (AMS; Vallerand, Blais, Brière, & Pelletier, 1989) assesses students' contextual motivation towards school activities. The AMS is composed of seven subscales. There are 4 items per subscale, thus 28 items in total. Each item represents a possible reason for going to school. Three subscales

respectively assess three types of intrinsic motivation: knowledge; accomplishment; and stimulation. CFA analyses provide support for these subtypes of IM (see Vallerand *et al.*, 1989). Three other subscales respectively assess types of extrinsic motivation: identified; introjected; and external regulation. The seventh subscale assesses amotivation. Items are scored on a 7-point Likert scale (1 = *not at all in agreement* to 7 = *completely in agreement*). The AMS has shown high levels of construct and concurrent validity as well as internal consistency (see Vallerand *et al.*, 1989). Cronbach alphas for these subscales ranged between .60 and .91 for the three data waves, though most of these values were over .80. Based on previous research and theory, we posited three latent motivation factors. A latent factor of *autonomous motivation* was formed on the basis of four subscales: IM related to knowledge; IM related to accomplishment; IM related to stimulation; and identified regulation (i.e. the mean of correlations for IM, and identified regulation was .54 across the three waves). A latent factor of *controlled motivation* was formed by using items from the introjected and external regulation subscales (i.e. the mean of correlations for these two constructs across the three waves was .50). Specifically, four indicators were built to form this latent construct by averaging the first items of both external and introjected regulations to form the first indicator (e.g. first indicator = mean of (reg1 + intro1)), the second items to form the second indicator (e.g. second indicator = mean of (reg2 + intro2)) and so on for the remaining items. A latent factor of *amotivation* was built by simply using the four items in this subscale.

Adolescents' representations of relatedness with parents and friends

We used the relatedness scale developed by Richer and Vallerand (1998) to assess these constructs. This scale is made up of 10 items designed to assess two factors: (a) intimacy (5 items) and (b) acceptance (5 items), rated on a 7-point Likert type scale (1 = *not at all in agreement* to 7 = *completely in agreement*). In the present study we combined the intimacy and acceptance factors because both factors are highly correlated (around .90 in the present study). Richer and Vallerand (1998) showed that this scale has high levels of construct validity as well as internal consistency. Cronbach alphas for the friends and parents subscales were all approximately .96 for each of the three data waves. We used three parcels of items to build three indicators for each of the two latent constructs designed to evaluate representations of relatedness *with parents and with friends*.

Statistical analyses

Reciprocal Effects Models (REM)

Marsh and Yeung (1998) proposed methodological guidelines to test reciprocal relations in multiwave-multivariable studies. These guidelines are based on structural equation modelling. First, each latent construct should be inferred on the basis of at least three indicators. Second, it is important to control appropriately for possible method/halo effects associated with the same measures collected on multiple occasions. Because the failure to control for these effects produces positively biased estimates of stability, tested models should always contain the correlation between the measurement errors of the same indicator through time. Third, constructs should be measured at least twice and the data should span at least 1 year. Fourth, an *a priori* model that estimates stability coefficients and hypothesized cross-lag effects among the constructs (see Figure 1) should be tested. Fifth, it is important to consider a sufficiently large sample to justify the generality of the findings. The present study meets all these guidelines.

Missing data

Descriptive analyses indicate that among the initial sample of 834 participants at Time 1, only 224 (27%) provided complete data at all three measurement times. This significant number of missing data could potentially influence results from CFA and SEM analyses. Two analyses were thus conducted to verify whether individuals who participated in all three waves differed from those who did not. First, we tested whether the sample of participants who completed all three measures was equivalent to and thus representative of other participants at Time 1 ($N = 610$). An SEM model was constructed in which the main effects of missing data (no missing data = 0, missing data = 1) were related to each of our five latent factors measured at Time 1. Fit indices for the SEM model were very good (see Table 2, Model 1) and only one of the five paths estimated was significant. It appears that those who did not participate at Time 2 and/or Time 3 had a slightly lower representation of relatedness with their parents than those who participated at all three data points ($\beta = -0.11$), but the magnitude of this effect was small.

Second, the measurement model at Time 1 was tested for factorial invariance across the two samples. Results of multiple-group analyses (see Table 2, Models 2–6) showed that the measurement model including type of motivation and representations of relatedness at Time 1 was invariant across the two groups in terms of their factor loadings, error variances, and covariances. Factor variances differed slightly for the two groups, but Bentler (1993) has suggested that this component of the measurement model is least important. Given the small magnitude of the differences with the SEM model and the highly restrictive test of invariance, we feel relatively confident that the missing observations in the present study do not create a threat to the validity of the study. Nevertheless, it would be inappropriate to disregard missing values by using a listwise deletion of cases (Davey, Shanahan, & Schafer, 2001). In the present study, we used the full information maximum likelihood (FIML) approach (version 6.1 of EQS) to estimate missing values.

Results

MANOVA and CFA¹

We first conducted a repeated measures analysis with MANOVA to verify whether there were fluctuations of means over time. Globally, the results of this analysis (see Table 1) indicate that autonomous motivation increased constantly through time, whereas relatedness with parents and friends increased only between Times 1 and 3. By contrast, amotivation decreased between Times 1 and 3. No significant differences were observed with regard to controlled regulation.

To provide an overview of the correlation pattern, we conducted a CFA. Results are presented in Table 2 (Model 7). Correlations among the 15 factors are presented in

¹ All structural equation modelling analyses were performed on covariance matrices using the Maximum-Likelihood estimation procedure. To ascertain the model fit, we used the Comparative Fit Index (CFI), the Non-Normed Fit Index (NNFI), the Root Mean Square Error of Approximation (RMSEA) and the chi-squared test statistic. The NNFI and the CFI vary along a 0–1 continuum, where values greater than 0.90 typically are taken to reflect an acceptable fit. Browne and Cudeck (1993) suggest that RMSEAs less than 0.05 are indicative of a 'close fit' and that values up to 0.08 represent reasonable errors of approximation. In the present study, various models are compared. Model comparison is also facilitated by positing a nested ordering of models in which the parameter estimates for a more restrictive model are a proper subset of those in a more general model (see Bentler, 1990). Under appropriate assumptions, the difference in chi squares between two nested models has a chi-squared distribution and so can be tested in relation to statistical significance.

Table 1. Means, standard deviations, and *F* tests

	T1		T2		T3		<i>F</i>
	Mean	<i>SD</i>	Mean	<i>SD</i>	Mean	<i>SD</i>	
Autonomous regulation	4.50a	1.02	4.72b	0.90	4.98c	0.83	$F(2, 834) = 252.60^*$
Controlled regulation	4.32a	1.21	4.28ab	1.13	4.28abc	1.05	$F(2, 834) = 1.92$
Amotivation	1.72a	1.12	1.66ab	0.78	1.42c	0.52	$F(2, 834) = 74.18^*$
Relatedness with parents	5.35a	1.32	5.38ab	1.14	5.53bc	1.06	$F(2, 834) = 38.24^*$
Relatedness with friends	5.53a	1.14	5.61ab	0.91	5.67bc	0.87	$F(2, 834) = 9.38^*$

Note. At $p < .05$. Different letters indicate significant differences.

Table 3. Motivational variables were mostly significantly correlated with representations of relatedness with parents and friends for the different measurement times. However, it is important to note that cross-sectional correlations connecting relatedness with friends to controlled regulation and amotivation were not significant at Times 2 and 3. These correlations thus suggest that significant cross-lag paths will likely not be obtained between these constructs in subsequent SEM analyses. In addition, stability coefficients were substantial for the three time points, ranging between .41 and .78 for the different constructs.

Table 2. Results of the multiple CFA and SEM models

Models tested	χ^2	<i>df</i>	CFI	NNFI	RMSEA	χ^2 diff.	<i>df</i> diff.
SEM							
Model 1	651.674	138	0.951	0.939	0.070	–	–
Invariance for missing data							
Model 2	804.215	250	0.947	0.936	0.054		
Model 3	826.431	263	0.947	0.938	0.053	(M3 vs. M2) = 22.216	13
Model 4	832.776	273	0.940	0.940	0.052	(M4 vs. M3) = 6.435	10
Model 5	853.691	278	0.945	0.940	0.052	(M5 vs. M4) = 20.915*	5
Model 6	889.550	296	0.944	0.939	0.051	(M6 vs. M5) = 35.859	18
CFA							
Model 7	2,416.521	1,218	1.000	1.001	0.034	–	–
SEM							
Model 8	2,487.204	1,254	1.000	1.002	0.034	–	–
Model 9	2,499.986	1,266	1.000	1.002	0.034	(M9 vs. M8) = 12.782	12
Model 10	2,528.374	1,278	1.000	1.002	0.034	(M10 vs. M9) = 28.388*	12
Model 11	2,506.472	1,269	1.000	1.002	0.034	(M11 vs. M9) = 6.486	3

Note. * $p < .005$.

SEM

Model 8 estimates all stability effects and some cross-lag paths (see Figure 1). However, the very good fit indices do not mean that all path coefficients estimated were significant. To test these paths in a more stringent way we tested two additional *a priori* models. In these models, we constrained selected sets of cross-lag path coefficients to be 0 in order

Table 3. CFA correlations among variables

Factors	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
F1–Autonomous–T1	–														
F2–Controlled–T1	.43*	–													
F3–Amotivation–T1	–.45*	–.03	–												
F4–Parents–T1	.25*	.09*	–.17*	–											
F5–Friends–T1	.24*	.10*	–.20*	.37*	–										
F6–Autonomous–T2	.70*	.27*	–.29*	.36*	.21*	–									
F7–Controlled–T2	.21*	.71*	.01	.18*	.07	.39*	–								
F8–Amotivation–T2	–.22*	.03	.41*	–.16*	–.04	–.35*	–.05	–							
F9–Parents–T2	.28*	.13*	–.13*	.76*	.33*	.39*	.16*	–.17*	–						
F10–Friends–T2	.19*	.02	–.13*	.19*	.59*	.24*	–.03	–.08	.40*	–					
F11–Autonomous–T3	.69*	.30*	–.30*	.24*	.18*	.69*	.21*	–.17*	.33*	.15*	–				
F12–Controlled–T3	.18*	.64*	–.02	.08*	.02	.17*	.71*	.01	.12*	–.03	.30*	–			
F13–Amotivation–T3	–.33*	–.05	.46*	–.18*	–.05*	–.31*	–.08	.46*	–.22*	–.11*	–.42*	–.09*	–		
F14–Parents–T3	.25*	.12*	–.20*	.73*	.39*	.37*	.15*	–.17*	.78*	.36*	.37*	.09*	–.25*	–	
F15–Friends–T3	.18*	.10*	–.08*	.38*	.56*	.23*	.07*	–.01	.36*	.55*	.28*	.05	–.07	.47*	–

Note. * $p < .05$.

to verify whether the omission of these paths led to a decrease in fit indices in terms of differences in chi-squared values. Note that in these models stability paths were always estimated. In Model 9, cross-lag paths among types of motivation and representations of relatedness with friends were set to 0, while in Model 10, the cross-lag paths involving parents and motivational components were set to 0, leaving only stability effects. We thus sought to verify whether the omission of cross-lag paths led to a decrease in fit indices in terms of differences in chi-squared values, as compared to a more general model. Where this was the case, we can argue that these cross-lag paths are potentially significant and need to be considered in the interpretation of the results (see Table 1 for the fit indices of the various models tested).

On the basis of results obtained under Models 8–10, we concluded that only the cross-lagged paths connecting representations of relatedness with parents and types of motivation were significant. Indeed, when we constrained these paths to 0 there was a significant difference in terms of chi-squared value whereas this was not the case when cross-lagged paths connecting representation of relatedness with friends and motivational components were set to 0. Results of Model 9 indicate that representations of relatedness with parents at Time 1 positively predicted autonomous and controlled motivations at Time 2 but negatively predicted amotivation. Between Times 2 and 3, however, only the path connecting representation of relatedness with parents and amotivation was significant ($\beta = -0.12$).² The fact that in Model 9, results were not equivalent between the waves is somewhat troublesome. However, observation of coefficients between Times 2 and 3 indicates that they were all in the same direction as the ones observed between Times 1 and 2, but that they were unfortunately non-significant. A powerful way to verify whether paths from each wave are equivalent is to proceed via constraint analyses. In such analyses, paths are fixed to be equal. If the model that contains fixed paths is found not to be different in terms of chi-squared value from the model in which these paths are freely estimated, this provides very good support for their equivalence. Results of this analysis provided support for the fact that these sets of paths were equivalent between both waves since there was no difference in chi-squared value between these models (Models 11 and 9). For this reason, results of the constrained model (Model 11) are depicted in Figure 2, and form the basis of our discussion.

Supplementary analyses

The final model depicted in Figure 2 shows a number of expected and meaningful findings but also some unexpected ones such as the positive association between representations of relatedness with parents and controlled regulation. One may wonder whether such unexpected findings are substantial or whether they result from the fact that the model contains so many parameters to estimate. In addition, one may suspect that the inclusion of both representations of relatedness (parents and friends) in the

² One may argue that the effect of friends might be more easily detected with regard to an outcome measure such as intrinsic motivation because experiences with friends are more closely related to the pleasure of coming to school (Kindermann, 1993). Related to this point, we verified whether the correlation between relatedness with friends and the intrinsic motivation components (knowledge, accomplishment, and stimulation) were higher than the correlation between relatedness with friends and the identified regulation component. Results indicate that, at Time 1, the correlation between relatedness with friends and intrinsic motivation was .20 whereas the correlation between relatedness with friends and identified regulation was .22. A quite similar pattern was observed for Times 2 and 3. Based on these results, it is difficult to argue that grouping together IM and identified regulation has cancelled out the effect of friends.

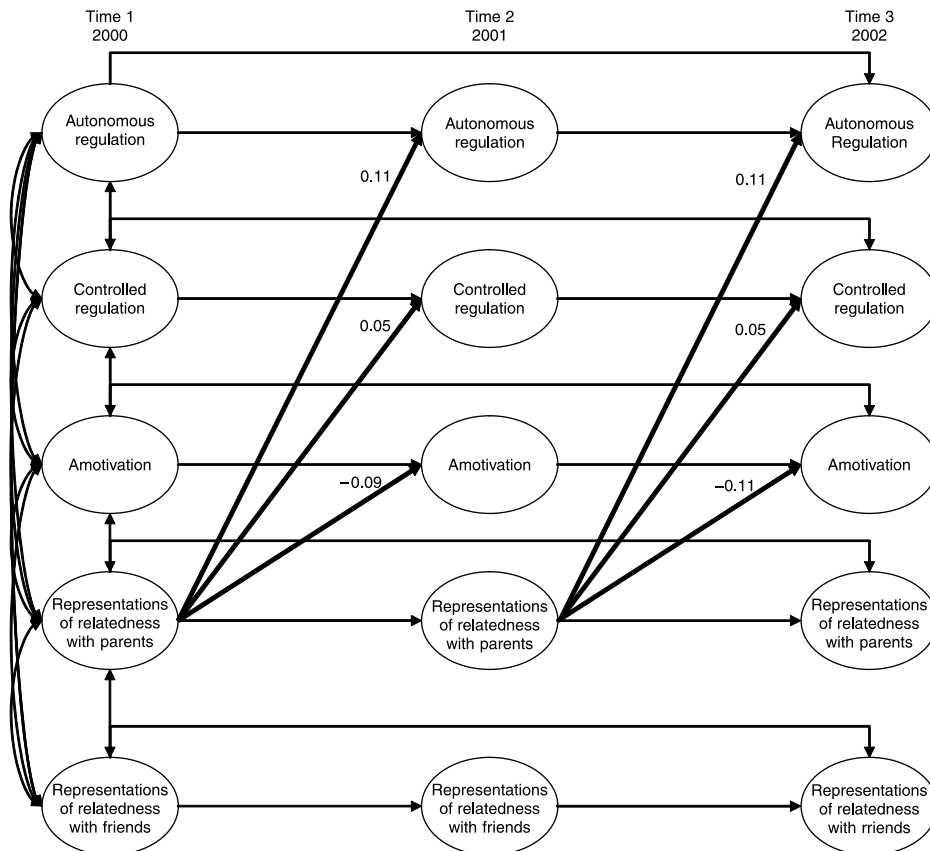


Figure 2. Final results.

same model may have cancelled out the effects of friends on subsequent motivation. To circumvent these problems, we performed two additional sets of analyses that involve fewer statistical parameters to be estimated and in which parents' and friends' effects were isolated. In the first set, only representations of relatedness with friends were considered in the model along with the three motivational variables. In the second set, only representations of relatedness with parents were included along with the three motivational variables. In these two supplemental sets of analyses, we tested two models: (a) a baseline model where all cross-lag paths were estimated and (b) a constrained model where cross-lag paths were set to 0. For analyses based on representations of relatedness with friends, it turned out that both models (i.e. all the cross-lag paths and the constrained model) were equivalent (i.e. the chi-squared difference was not significant). This indicates that the reciprocal effects between representations of relatedness with friends and types of motivation were not highly significant. For analyses based on representations of relatedness with parents, it appears that both models differed. In addition, path coefficients were similar and in the same direction as those observed in Figure 2. In sum, having included both types of effects (friends and parents) in the same model does not seem to explain the positive association between representations of relatedness with parents and controlled motivation or to have cancelled out the effect of friends.

One may be struck by the fact that only 224 participants completed all three measurement waves and that we decided to estimate missing data for the 610 participants who dropped out of the study. Consequently, we explored alternative approaches to the missing values issue in which we tested our final model (Model 11) with (a) listwise deletion for missing data and (b) an FIML approach based on participants who provided complete data for two of the three waves. Results were very similar across the different approaches. Because results were relatively the same in both approaches to missing values (i.e. listwise and FIML on two waves), we feel very confident that the estimation of the missing values in the present study does not represent a threat to the validity of the study.

Discussion

The purpose of the present study was to test causal ordering among representations of relatedness with parents and friends and academic motivation during the late adolescence–early adulthood period. Specifically, we investigated in a reciprocal effects model with three waves of data, how representations of relatedness and academic motivation influence each other. Some support was found for the hypothesis that representations of relatedness with parents affect academic motivation but rather weak support for the hypothesis that academic motivation influences representations of relatedness with parents. In addition, no support was found for the effects of either prior representations of relatedness with friends on subsequent motivation or prior motivation on subsequent representations of relatedness with friends. This last finding challenges some developmental models that argue that friends are more important in late adolescence than parents. We will now explore these results in greater details.

The effects of representations of relatedness with parents on adolescents' motivation

Results indicate that students who have representations of secure and intimate relationships with their parents experienced higher levels of autonomous and controlled motivations at Time 2 and conversely lower levels of amotivation. Similar results were observed at Times 2 and 3. These results are thus robust across the different waves of data collection and corroborate SDT. However, one finding is inconsistent with SDT. We observed a positive relation between Time 1 representations of relatedness with parents and Time 2 controlled motivation, while SDT would posit a negative relation between these constructs. Specifically, this theory hypothesizes that a secure relationship between students and parents leads to a better integration of behaviours in the self and thus to a low level of controlled motivation. Furthermore, it is noteworthy that correlations between representations of relatedness with parents and controlled regulation are positive for each wave. In order to explain this unexpected positive relation, we speculate that some students may feel connected to their parents because their parents use autonomy-supportive practices (i.e. listening, acknowledging feelings, offering choices) but parents may also, on some occasions, put pressure on the students to succeed at college, thereby leading to a positive relation between both constructs. Hence, caring parents may sometimes use pressure or control to motivate their adolescents, especially when adolescents are tempted to make choices that are incongruent with school values. In addition, it is important to keep in mind that engaging in academics inherently involves both the autonomous and controlled motivations. Indeed, many studies have found a positive relation between autonomous

and controlled motivation in education. Thus, parental practices may mirror the autonomous and compulsory aspects of education. Of course, this speculation needs to be tested in further research.

Another result that appears relatively surprising is that prior motivation does not seem to lead to subsequent representations of relatedness with parents. Specifically, the fact that some students are highly motivated does not appear to increase the representations of relatedness that they have towards their parents. This absence of significant results may stem from the fact that in the late adolescence–early adulthood period the relationship with parents is much more stable than at other developmental periods, which can be more disruptive. Indeed, in adolescence, where values endorsed by students are sometimes in conflict with those of the parents, these effects could be much stronger. In addition, this lack of effects may be explained by the fact that parents have fewer contacts with their offspring in the late adolescence–early adulthood period. Thus, it becomes more difficult for parents to behave in accordance with their adolescents' motivation towards college.

The effects of representations of relatedness with friends on adolescents' motivation

Results indicate neither effects of prior representations of relatedness with friends on subsequent motivation nor effects of prior motivation on subsequent representations of relatedness with friends. This absence of significant effects is, perhaps, surprising in the light of some developmental frameworks that propose that peer group has a strong influence on an adolescent's outcomes and development. Indeed, Steinberg, Dornbusch, and Brown (1992) suggest that while parents play a critical role in students' educational plans and goals, peers are probably one of the most potent sources of influence on behaviours such as how much they enjoy coming to school every day. Nevertheless, our findings are in line with previous studies showing that during some developmental periods such as the late adolescence–early adulthood period, students rely more on parents (Larose & Boivin, 1998), most likely because during this period a school transition occurs. Indeed, most individuals during the late adolescence and early adulthood period face an important developmental challenge, which is the transition to college. Indeed, college in the Quebec educational system refers to a post-high school but pre-university institution, which offers 2-year (for the programme leading to university) or 3-year (for the technical terminal programme) programmes. According to Larose and Boivin, these social and emotional changes force the college freshman to rely more upon family members for support and security during this stressful transition period. These results may suggest that interventions that focus on representations of relatedness with parents will be much more effective than interventions that focus on friends, in terms of increasing academic motivation during this developmental period. However, future studies are definitively needed to test the robustness of this effect with other samples and outcomes.

Limitations and future research directions

First, there are some controversies surrounding the possibility that the SEM longitudinal analyses carried out in this study can 'capture' causal processes because a third variable could explain relations between the variables that are the focus of the causal model. However, it is not possible to collect appropriate measures of all potential third variables (i.e. SES, intact families vs. non-intact ones) and therefore this alternative explanation will always remain a threat to the validity of interpretations. We recognize that causal interpretations need to be made cautiously here as well as with true

experimental design. However, we believe that the multivariable–multiwave–multitem SEM is probably the strongest basis of inference of causal effects based on non-experimental data. *Second*, we observed a high level of missing values in the present study. Results from invariance analyses and the SEM model indicate few differences between participants who provided complete data and those for whom values were missing. In addition, we used a sophisticated approach to missing values (FIML) to resolve the problem. In the light of this, we believe that missing data do not create a threat to the validity of our study. Nevertheless, it is quite possible that the sample of the present study is not representative of the entire college population in that our students maybe more academically oriented and well adjusted. We thus need to be careful about the generalization of the present results. *Third*, the number of parameters included in our various SEM models was relatively high. However, it is important to note that the ratio of participants to parameter estimates traditionally used in SEM analyses is debatable. Whereas there are widely noted ‘myths’ associated with the minimum sample size required to achieve stable solutions, these are rarely based on empirical support and are no longer used as appropriate guidelines (Velicer & Fava, 1987, 1998). *Fourth*, we did not take into account friends’ and parents’ characteristics. Indeed, Berndt (1999) has suggested that quality of relationships with friends should preferably be studied along with friends’ characteristics. For example, if a student has very good relationships with some friends who are not academically oriented, this may produce low levels of autonomous academic motivation. In addition, a student who has a good relationship with his/her parents may have high levels of autonomous motivation if his/her parents value academic work. Representations of relatedness with significant others may thus have a greater impact on motivation when there is a fit between values endorsed by significant others and those of the school. *Fifth*, it is possible that teachers or the classroom context may explain a significant and important portion of variance in motivational components. Further tests of the model should thus include these effects.

Conclusion

It is important to emphasize that the present results also have some practical implications. Indeed, it might be important to inform parents that they may still have an influence on their adolescent’s representations of relatedness and subsequently on their academic motivation even during the late adolescence–early adulthood period, a period when some parents may be tempted to believe that they can do little to motivate their offspring. Parents may thus use autonomy-supportive practices to enhance the quality of their relationship with their older adolescent, such as acknowledging his/her feelings, providing choice and information, being interested and involved in his/her education, and providing positive feedback.

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