

Family Correlates of Trajectories of Academic Motivation During a School Transition: A Semiparametric Group-Based Approach

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The present study examined whether academic motivations, conceptualized from the stance of self-determination theory, fluctuate over time in a homogeneous or heterogeneous fashion during a school transition. Three objectives were pursued: First, motivational trajectories were studied using the conventional, homogeneous approach. Second, the group-based, semiparametric approach to developmental trajectories was used to study heterogeneous motivational trajectories. Third, family factors were compared across trajectory groups for each type of motivation. Results suggested that most types of motivation tend to fluctuate differently over time for distinct groups of individuals. Furthermore, students characterized by problematic motivational trajectories perceived their parents to be less involved in their scholastic work and less autonomy supportive than those of other students. Results are discussed in terms of their implications for research and theories on motivation and parenting.

Many research efforts have been dedicated to understanding factors that can foster academic success. An important factor that has been identified in students' academic path is the experience of a school transition. Longitudinal studies revealed that school transitions are usually associated with negative effects, such as lower grades, loss of interest and intrinsic motivation, diminished feelings of competence, lower self-esteem, increased stress and solitude, higher perceived school hassles and strain, making less effort, as well as lower GPA (Isakson & Jarvis, 1999; Larose & Boivin, 1997; Roeser, Eccles, & Freedman-Doan, 1999; Rudolph, Lambert, Clark, & Kurlakowsky, 2001; also see Wigfield, Eccles, & Pintrich, 1996).

Although school transitions can affect several academic dimensions, motivation is an important dimension to consider because it can predict important academic outcomes like performance and persistence (see Bandura, 1997; Reeves, 2002; Vallerand, 1997; Wigfield & Eccles, 2000). Hence, because motivation is a key variable for predicting various dimensions of student functioning, attending to its fluctuations during transition periods appears to be quite important. Longitudinal studies have revealed that feelings of competence and motivation tend to decrease over time, that such

an undermining is most pronounced immediately after the transition, and that it tends to continue in subsequent years (see Wigfield & Eccles, 2000; Wigfield et al., 1996).

There are two main categories of motivational research on school transition. The first category consists of studies that have examined average motivational change across transition. These studies have found transitions to be a risk factor for academic motivation. Such a statistical approach to studying motivational trajectories can be misleading because, as in all regression types of analyses, it suggests that transition affects the majority of students in a similar way. It thus becomes tempting to conclude that a school transition can put most students at motivational risk.

The second category of research on motivational development consists of studies that have examined motivational trajectories during transitions as a function of moderating variables. Such an analytical approach suggests that transitions do not put most students at risk but only a subset of them. For example, Harter, Whitesell, and Kowalski (1992) examined motivational development as a function of perceived competence where students were categorized on the basis of competence fluctuations across the transition (decreasing competence, increasing competence, and stable). Results indicated that the school transition was not a risk factor for students' motivation when they perceived themselves to be increasingly competent. Other moderators were studied and, overall, school transitions have been found to be a motivational risk factor for students who perceive low ability, are poorly adjusted, are taught by a low-efficacy teacher, and are in competitive classrooms (Anderman, Maehr, & Midgley, 1999; Eccles et al., 1989; Fredericks & Eccles, 2002; Midgley, Feldlaufer, & Eccles, 1989; Roeser et al., 1999).

Despite the importance of previous studies, it must be acknowledged that this research is characterized by certain significant shortcomings. First, the analysis of motivational fluctuations as a function of moderators entails forcing individuals into trajectory groups (i.e., groups are not naturally occurring). Hence, it could be that the growth curve for a specific group (e.g., high-ability group) would be misleading because it averages motivational scores for

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participants showing different motivational patterns (i.e., whose motivational orientation is quite different—some highly motivated, others not at all, etc.). The conclusions drawn would thus be based on a mean motivational score derived from a group of participants who, although having relatively similar scores on such variables as ability, might not have similar motivational profiles. We believe that the understanding of motivational trajectories would benefit greatly from the study of naturally occurring trajectory groups.

Another limitation that is characteristic of research on motivational trajectories pertains to the conceptualization of motivation (defined as the reasons underlying one's behavior, thoughts, and actions; Pittman, 1998). There can be several reasons, or motivations, underlying one's behavior, and this multidimensionality is important to consider, especially in order to accurately predict motivational consequences (see Vallerand, 1997). Unfortunately, the longitudinal studies reviewed above conceptualized motivation as a unidimensional construct. Examining motivational fluctuations from a multidimensional perspective may reveal new and different information as the different dimensions of motivation may act differently over time, within different groups of individuals. To overcome this limitation, we proposed the use of a more complete motivational theory, as detailed in the following section.

Finally, in the literature on school transition and its motivational outcomes, we find that parental contribution has been understudied. Studies have highlighted the importance of two basic parental dimensions with respect to student functioning: parental involvement (i.e., the provision of resources to the child) and autonomy support (i.e., the affirmation of the child as a unique, active, and volitional individual; see Grolnick, 2003). Specifically, parental involvement and support of his or her child's autonomy with respect to academic activities were found to predict positive outcomes such as achievement and feelings of competence. However, little is known as to whether parental involvement and autonomy support can act as buffers to school transition. Previous research actually found positive relations between these parental dimensions and indices of student functioning following a school transition (Isakson & Jarvis, 1999; Lord, Eccles, & McCarthy, 1994; Ratelle, Larose, Guay, & Senécal, in press). Also, Eccles, Lord, and Buchanan (1996) suggested that parental style could act as a protective factor during school transitions.

Self-Determination Theory

The theoretical framework of self-determination theory (SDT; Deci & Ryan, 1985, 1991, 2000), which proposes a multidimensional perspective on motivation, is a potent solution to the unidimensional study of motivation. It proposes different types of reasons for one's behavior, which can be ordered on a self-determination continuum. At the highest end is *intrinsic motivation* (IM), which represents the most self-determined form of motivation. IM implies performing behaviors for the pleasure and satisfaction inherent to them. The next type of motivation is labeled *extrinsic motivation* (EM) and refers to engaging in an activity for reasons outside of this activity. There are different types of EM, which vary in their level of self-determination. The least self-determined form of EM is *external regulation* and implies performing a behavior in order to obtain a reward or avoid a punishment. A second type of EM is *introjected regulation*, defined as

activity engagement based on environmental prompts that are internalized in the self-structure but in a nonself-determined fashion. Such incoherent integration of environmental demands gives way to behaviors performed out of guilt and obligation. A third type of EM is *identified regulation*, where behaviors are based on personal choice and importance. Such regulatory style represents the most self-determined form of EM and is characterized by a coherent, self-determined internalization of environmental prompts. Finally, *amotivation*, which entails a lack of contingency between one's actions and their consequences, represents an absence of motivation.

This theoretical framework on motivation has been applied to the education domain in several empirical studies (e.g., Ryan & Connell, 1989; Vallerand, Blais, Brière, & Pelletier, 1989; Vallerand et al., 1992, 1993; for reviews, see Ryan & Deci, 2000; Vallerand, 1997). Across these studies, we find that the most positive outcomes (e.g., positive emotions in school, concentration, persistence, etc.) are associated with self-determined forms of motivation, whereas the most negative outcomes are usually associated with the nonself-determined forms of motivation (for a review, see Vallerand, Fortier, & Guay, 1997).

A Group-Based Approach to Studying Developmental Trajectories

Typically, motivational trajectories have been analyzed using what we refer to as the "conventional approach," where the focus is on mean-level fluctuations, using statistical techniques like hierarchical linear modeling (Raudenbush & Bryk, 2002) and latent growth curve modeling (Willett & Sayer, 1994). Such an analytical approach models population variability, but because it does not assess the heterogeneity of the sample, it prevents the detection of distinct trajectories of motivation, which can sometimes be opposed. The development of new statistical methods allows for the detection of developmental heterogeneity and the joint analysis of these different behavioral patterns using a multinomial modeling strategy. One such methodology is a mixture modeling statistical approach proposed by Nagin (1999). This semiparametric, group-based approach is designed to identify subgroups of participants displaying distinct levels of a variable (in this case, academic motivations) and describe the observed pattern of change for each. Because this method allows the identification of a mixture of groups, it becomes possible to locate a group of students reporting constantly high levels of IM together with another group that has a declining trajectory for this factor. Furthermore, the group-based approach performs a statistical function akin to clustering techniques, based on their levels and patterns of fluctuations on a measure, only it does so over several repeated measures. Hence, this ability to consider multiple measurements simultaneously presents an advantage over other statistical techniques that only examine change between two points in time.

The Present Study

The goal of the present study was to overcome the limitations characteristic of previous research on motivational development during transitions. First, we examined fluctuations in types of academic motivation over time for all individuals (i.e., assuming homogeneity). Research on the motivational outcomes of school

transitions only examined the transition to high school, which is characterized by increased control and competition and fewer opportunities to make choices (Eccles et al., 1996). Given the paucity of studies on the outcomes of a college transition, no predictions were made. Second, to overcome the limitations associated with a homogeneous or forced-grouping approach to motivational trajectories, we used a semiparametric, group-based approach to studying developmental trajectories. Because the study of motivational styles using this approach was exploratory, we did not have specific hypotheses as to the number of trajectory groups for each motivation or the shape of these trajectories. Third, given that there are heterogeneous motivational trajectories, and in line with the extensive literature on parental styles, we hypothesized that, to the extent that parents are involved and autonomy supportive of the child's education, students should display more self-determined trajectory profiles toward school (e.g., more IM, less external regulation, etc.).

We also included measures of socioeconomic status (SES) to rule out the possibility that it would explain the relation between motivational trajectories and parental styles. As suggested by Gottfried, Fleming, and Gottfried (1998), it is important to make sure that the effect of family on motivation is not dependent solely on the role of SES because it does not inform us about the processes whereby the familial environment enhances or undermines motivation. Also, because academic motivational styles have been associated with academic achievement (e.g., Deci & Ryan, 2002; Guay & Vallerand, 1997), we added this measure to examine its relation to trajectory groups.

Method

Participants and Procedure

Participants were 729 young adults (373 female, 356 male) recruited in their last year of high school throughout the Province of Québec, Canada. Their mean age was 17 years ($SD = 1.47$), and most of them were francophone (more than 96%). Participants were recruited as part of a longitudinal research project on scientific workforce renewal in Québec. The present article deals with a portion of the data. This sample was composed of students who decided to pursue their collegial studies in scientific disciplines (in Québec, high school students must attend college before entering university). At Time 1 (T1), at the end of their last high school year, participants completed demographic information (e.g., age, SES) as well as high school science achievement and measures of academic motivations. At Time 2 (T2), a year later (i.e., end of their first college year), participants completed measures of perceived autonomy support and perceived involvement from parents (retrospection on T1) as well as academic motivations. At Time 3 (T3; end of their second year in college), participants completed a measure of academic motivations.

Of the initial sample ($N = 729$), a total of 316 students completed all questionnaires (from T1 to T3), which represents a 43% response rate. When comparing students who completed all measures with students for whom we only have data at T1, significant differences were found on a few measures, Wilks's $\Lambda(9, 689) = .95, p < .01$. Students who completed all measurement times had higher science grades in high school, came from more highly educated families, and reported more self-determined motivations in high school than students who only completed T1 measures (all $ps < .05$). However, the magnitude of these effects was quite small, explaining between 1% and 2% of the variance (Cohen, 1977). Also, a contingency analysis revealed that the distribution of men and women in each group (those who completed all measurement times vs. those who completed only T1 measures) was significantly different, $\chi^2(1, N = 729) =$

9.10, $p < .01$. Although each group appears to have roughly the same number of men, there were more women who completed only T1 measures than women who completed all measures.

Measures

Parental Autonomy Support. This unidimensional scale, administered at T2, assesses the extent to which parents, during their child's last year of high school, supported the students' autonomy in making the decision to pursue a college education in science.¹ Items (eight in total) were adapted from Paulson, Marchant, and Rothlisberg (1994) and from Robinson et al. (1995). Individuals had to indicate, on a 5-point scale, ranging from 1 (*totally disagree*) to 5 (*totally agree*), the extent to which each item reflects how parents and children came about discussing the decision to pursue college studies in science. A sample item is "My parents allowed me to have my own point of view regarding my choice of program." Previous research has found these scales to display satisfying psychometric qualities (e.g., Chipman, Olsen, Klein, Hart, & Robinson, 2000; Paulson, 1994). In the present study, Cronbach's alpha suggests that this measure is reliable ($\alpha = .87$).

Parental Affective Involvement. This unidimensional scale, administered at T2, is designed to measure parents' affective involvement in their child's vocational process through open and heartfelt discussions during the last year of high school. This 10-item scale was adapted from Barnes and Olsen (1992). Individuals had to indicate, on a 5-point scale, ranging from 1 (*totally disagree*) to 5 (*totally agree*), the extent to which each item reflects how parents and children came about discussing the decision to pursue college studies in science. A sample item is "It was easy for me to express my true feelings to my parents when the issue was about my choice of program." This measure was found to be psychometrically sound (Barnes & Olson, 1992) and, in the present study, displayed high reliability ($\alpha = .81$).

Academic motivations. The Academic Motivation Scale (AMS; Vallerand et al., 1989, 1992, 1993) was used to assess the reasons students hold for pursuing their studies. This multidimensional scale measures five different types of reasons (four items each). Participants had to indicate, on a 7-point scale, the extent to which they pursue their studies out of IM (e.g., "For the pleasure and satisfaction of learning new things in this program"), Identified Regulation (e.g., "Because I think that this program will help me better prepare for the career I chose"), Introjected Regulation (e.g., "To prove to myself that I can succeed in this program"), External Regulation (e.g., "Because this program will allow me to get a lucrative job later"), and Amotivation (e.g., "Honestly, I don't really know; I really have the impression that I'm wasting my time"). Previous studies have found high levels of reliability and validity for the AMS (see Vallerand et al., 1989, 1992, 1993). In the present study, indices of internal consistency for the different subscales were acceptable, ranging from .75 (for the Identified Regulation subscale at T2) to .95 (for the IM subscales at T2 and T3).

¹ Parental dimensions (involvement and autonomy support) were examined using students' perceptions of their parents. This is common practice in the literature on parental styles where the role of parental involvement and autonomy support has often been examined from the child's perspective (e.g., Grolnick, Ryan, & Deci, 1991), although some studies did take parents' perspective into account (especially when children are young; e.g., Grolnick & Ryan, 1989). We believe that late adolescents have the cognitive maturity to evaluate their parents' behavior in a more objective manner. Actually, research by Sessa, Avenevoli, Steinberg, and Morris (2001) showed that children are more accurate judges of parenting dimension than parents themselves.

Statistical Analyses for Group-Based Trajectories

Trajectories of academic motivations (for the five subscales of the AMS) were modeled using the T1, T2, and T3 scores on the AMS. Semiparametric mixture models for each motivational style were estimated using the SAS procedure labeled *TRAJ* that was developed by Jones, Nagin, and Roeder (2001). With this method, it is possible to identify, for each motivation style, the number of groups of students displaying distinct motivational trajectories, describe the shape of these trajectories for each subgroup (i.e., whether there are variations or whether the pattern is stable), and estimate the proportion of students in each trajectory group.

First, the identification of the optimal number of groups was obtained by estimating models with two, three, and four groups. Second, the shape of each trajectory was determined by estimating models with stable and linear shapes of trajectories (or parameters). The output produces levels of significance for each trajectory group. Deciding which model best fits the data was done on the basis of the Bayesian Information Criterion (BIC), calculated as follows: $BIC = -2\log(L) + \log(n) * k$, where L is the model's maximized likelihood, n is the sample size, and k is the number of parameters in the model (Nagin, 1999). Although there are no clear guidelines for interpreting the magnitude of the BIC, the optimal model was deemed to be the one with the maximum BIC value. Because BIC is always negative, the maximum value is the least negative one.

Third, for every participant, the procedure calculated the probability of belonging to each group based on an observed longitudinal pattern (Nagin, 1999). It also determined the assigned trajectory group membership based on the highest classification probability across groups (or maximum probability rule). Taken together, these two estimates provided information on the fit of the model. Hence, students belonging to a particular trajectory group should have a high mean probability (maximum of one) of assignment to the group to which they belong on the basis of the maximum probability rule and a low mean probability (minimum of zero) of being assigned to other groups. A good fit would be indicated by probabilities around .70–.80 or higher. Finally, because this statistical procedure accommodates missing data, it was possible to use participants for which two of the three questionnaires were completed (see Nagin, 1999). Thus, the sample size for group-based developmental trajectories was sometimes higher than 316.

Results

This section presents the statistical analyses that were performed. First, an overview of the preliminary analyses and gender differences will be provided. Second, motivational trajectories will be examined using the conventional approach. That is, we will examine how academic motivations fluctuate over time for all individuals (i.e., assuming that motivational development is homogeneous). Third, we will examine motivational trajectories using a semiparametric, group-based approach, which assumes heterogeneous development. Finally, trajectory groups will be compared in terms of family variables.

Preliminary Analyses and Gender Differences

To begin, we made sure that the data met the basic statistical assumptions. For the present sample, we found the data to be normal, independent, and homoscedastic. We then examined gender differences and found that men and women responded differently on several measures, Wilks's $\Lambda(21, 267) = .73, p < .01$. Univariate tests suggested that, in comparison with women, men had more educated parents, were more externally regulated in general at school (i.e., at each time point) as well as more amotivated at the end of college, and perceived less involvement on the

part of their parents (all $ps < .05$). Overall, these gender differences were small, with effect sizes ranging from .01 to .10 (Cohen, 1977). Nevertheless, these discrepancies, especially with respect to motivational styles, are consistent with previous findings where women usually reported being more self-determined at school than men (see Vallerand, 1997). Gender will thus be considered in forthcoming analyses.

Conventional Approach to Trajectories of Motivation

We began by examining fluctuations over time for each motivational style using the conventional approach (i.e., assuming homogeneous development). First, we performed correlational analyses to assess the temporal stability of each type of motivation. As the results suggest (see Table 1), introjected regulation and external regulation appear to be the most stable types of motivation, with correlations ranging from .34 to .57. It also seems that motivational types are more stable within college (i.e., between T2 and T3), which might reflect a transition effect from high school to college. Specifically, we see that the T1–T2 correlations appear weaker for IM, identified regulation, and amotivation (ranging from .00 to .22) than the T2–T3 correlations (ranging from .36 to .50). Thus, although motivational styles are affected by transition, there seems to be some stability, especially for nonself-determined forms of EM.

Second, we examined mean scores on each motivation scale over time (see Figure 1). For the IM subscale, results suggest that the level of IM experienced by students in high school (T1) is significantly lower than that experienced in college (T2 and T3; $ps < .01$ for pairwise comparisons). Such findings appear contradictory to those obtained by Eccles and her colleagues (see Wigfield & Eccles, 2000) and will be discussed later on. For Identified Regulation, it appears that mean level at T1 is significantly higher than T2 and T3 mean levels ($ps < .05$ for pairwise comparisons). For Introjected Regulation, we found that the mean level decreased significantly at T2, as the T1 level is significantly higher than both T2 and T3 levels (evidenced by planned comparisons; $ps < .01$). On the External Regulation subscale, the mean level at T1 is significantly higher than at T2 and T3 levels, as suggested by pairwise comparisons ($ps < .05$). Finally, mean scores on Amotivation did not differ across the three measurement times, suggesting some sort of stability in students' reported level of amotivation over time.

In sum, the correlational analyses revealed that nonself-determined forms of motivation are more stable over time than

Table 1
Temporal Stability of Academic Motivation Styles

Subscale	Time 1–Time 2	Time 2–Time 3	Time 1–Time 3
Intrinsic Motivation	.13*	.50**	.12*
Identified Regulation	.22**	.39**	.09†
Introjected Regulation	.37**	.51**	.34**
External Regulation	.54**	.57**	.40**
Amotivation	–.00	.36**	.04

Note. Time 1 = end of students' last year of high school; Time 2 = end of students' first year of college; Time 3 = end of students' second year of college.

† $p < .10$. * $p < .05$. ** $p < .01$.

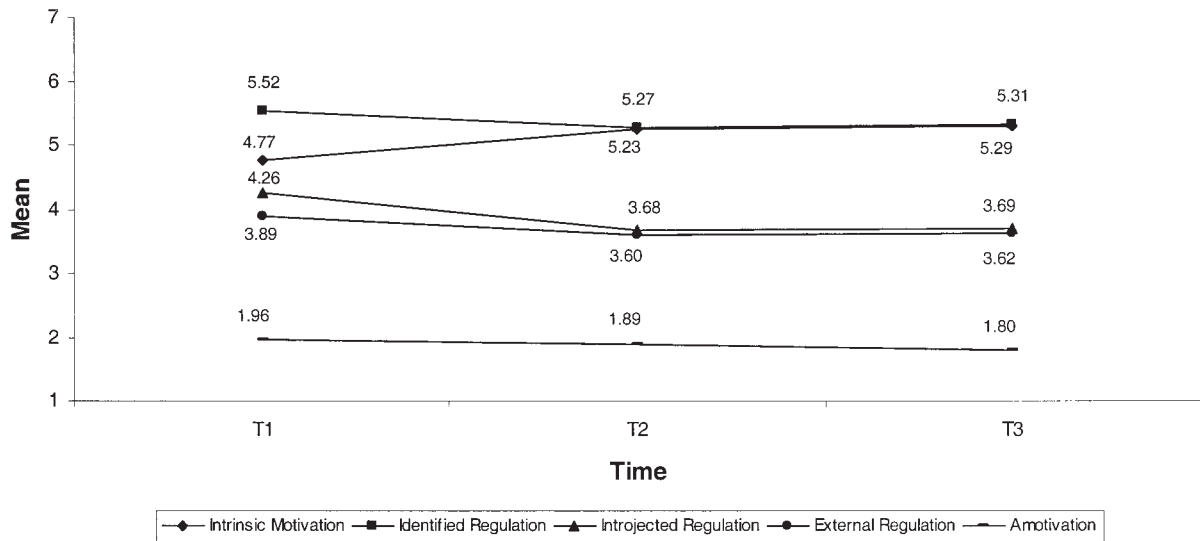


Figure 1. Motivational trajectories using the conventional approach. $n = 309$. T1 = Time 1 (end of students' last year of high school); T2 = Time 2 (end of students' first year of college); T3 = Time 3 (end of students' second year of college).

self-determined motivations. Furthermore, trend analyses suggest that most motivational styles changed significantly from T1 to T2 but not from T2 to T3. That is, between the end of high school and the end of the first college year, students reported increases in IM and decreases in EMs (identified, introjected, and external regulations). On the basis of the findings from high school (T1) to college (T2), it could be argued that there is a positive transition effect for most students because most of them experience an increase in IM and a decrease in introjected and external regulation (although a decrease in identified regulation was obtained). However, as pointed out earlier, we believe that these findings may be misleading because they do not take into account the heterogeneity of the sample. We now turn to the study of heterogeneous trends of motivational development.

Group-Based Approach to Trajectories of Motivation

A group-based analysis of motivational trajectories was then carried out. We will first present selected models for the different motivational subscales (number of trajectory groups and the shape of their trajectory). Second, trajectory groups on each motivation subscale will be contrasted in terms of parental dimensions. Table 2 presents mean assignment probabilities, which were conditional on assignment by the maximum probability rule. Probabilities varied from .62 to .95, although the majority were around .70 or .80, suggesting appropriate model fits.

For Amotivation, the BIC-based model selection procedure suggests that the three-group model best fits the data. Figure 2 illustrates trajectories of amotivation, where solid lines represent actual trajectories (i.e., mean scores for participants in groups identified by the TRAJ procedure) and dotted lines represent predicted trajectories, calculated using the model's coefficient estimates. Participants in each trajectory group share similar patterns of variation and levels on the Amotivation subscale across the three measurement times. The first group constitutes 14.5% of

the sample and is identified as the acute decliners group because these individuals report moderate amotivation at T1 but experience a steep drop at T2, which remains stable at T3. The second group, representing 79.8% of the sample, is identified as the decliners group. These students experience a significant undermining of amotivation from T1 to T2, which continues to decline at T3. Nevertheless, this second group remains more amotivated than the first one over time. Finally, a third group (5.7% of the sample) can be identified as the moderates, reporting steady, moderate levels of amotivation over time. For both the acute decliners and the decliners groups, we found that the linear parameters were statistically significant ($ps < .01$), which suggests that for these individ-

Table 2
Mean Assignment Probabilities to Group Trajectories for Each Motivational Style (Conditional on Assignment by Maximum Probability Rule)

Subscale	M	SD
Intrinsic Motivation		
Decliners (Grade 1)	.74	.17
Moderate increasers (Grade 2)	.62	.12
High increasers (Grade 3)	.75	.14
Identified Regulation		
Decliners (Grade 1)	.84	.13
High (Grade 2)	.95	.09
Introjected Regulation		
High (Grade 1)	.87	.14
Low (Grade 2)	.86	.15
External Regulation		
Low (Grade 1)	.90	.13
High (Grade 2)	.90	.14
Amotivation		
Acute decliners (Grade 1)	.66	.03
Decliners (Grade 2)	.90	.14
High (Grade 3)	.73	.15

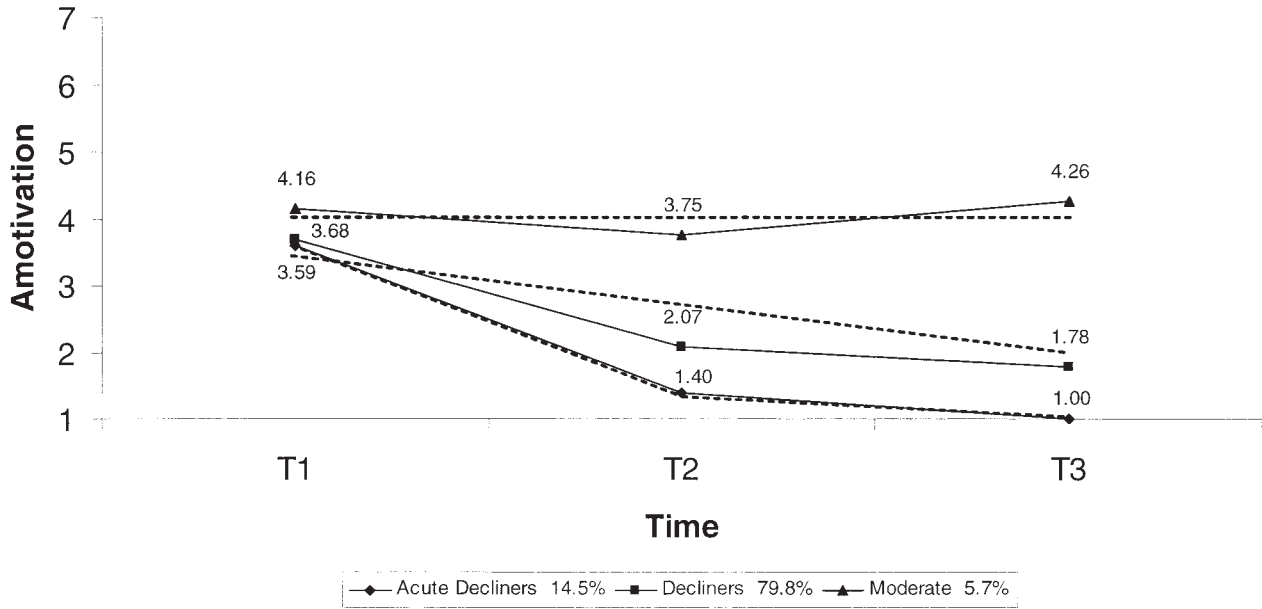


Figure 2. Group-based approach to motivational trajectories: Amotivation. Dotted lines represent predicted trajectories. T1 = Time 1 (end of students' last year of high school); T2 = Time 2 (end of students' first year of college); T3 = Time 3 (end of students' second year of college).

uals, the drop in amotivation is constant over time. Interestingly, these three trajectory groups appear quite different in shape and magnitude to the homogeneous trajectory depicted in Figure 1. Indeed, we see that, taken together, students of our sample appear to experience stable, low levels of amotivation over time. However, this unique trajectory masks the presence of different amotivation profiles (hence the usefulness of examining heterogeneous trajectories).

Following the identification of trajectories of amotivation, we examined whether these three groups differed from each other in terms of parental dimensions (affective involvement and autonomy support) as well as demographic (gender, parental education, and income) and academic (high school achievement) variables. A multivariate analysis of variance (MANOVA) was first performed and yielded significant results, Wilks's $\Lambda(14, 740) = .91, p < .01$, which indicates that the three amotivation trajectory groups significantly differ from each other on several variables. Univariate

tests indicated that acute decliners perceived their parents as more involved and autonomy supportive than other students and that decliners perceived their parents as more involved and autonomy supportive than moderates (see Table 3). However, trajectory groups did not differ on demographic and achievement measures. Furthermore, we conducted contingency analyses to examine whether trajectory groups differ in terms of the distribution of men and women. For both, there were no significant chi-square differences ($ps < .05$), suggesting homogeneous distributions across groups. Thus, parental style appears to contribute to the timely decrease in amotivation evidenced by some students.

We then carried out the analysis of External and Introjected Regulations. For both subscales, the BIC-based procedure for model selection identified a two-group model as the best-fitting solution. The first group is identified as the low group and the second group as moderate. Each group constitutes roughly half of the sample (low: 54% for External Regulation and 45.2% for

Table 3
Comparison of Trajectory Groups on Demographic, Academic, and Familial Variables: Amotivation

Variable	Acute decliners	Decliners	Moderate	F(2, 376)	ES
Achievement in science	4.59	4.30	4.40	1.25	.01
Family income	3.49	3.40	3.90	0.63	.00
Parents' education level	4.75	4.68	5.15	1.32	.01
Parental involvement	4.35 _a	4.20 _b	3.65 _c	6.72**	.03
Parental autonomy support	4.59 _a	4.31 _b	3.89 _c	10.89**	.05

Note. For each dependent variable, means having the same subscript are not significantly different at $p < .01$ in the Tukey honestly significant difference comparison. ES = effect size.
** $p < .01$.

Introjected Regulation; moderate: 46% for External Regulation and 54.8% for Introjected Regulation). With respect to both types of nonself-determined EMs, we found that the two groups have flat trajectories over time, indicating that external and introjected regulations are stable over time (see Figures 3 and 4). These findings mirror those obtained above when participants are considered as a unique group (see Figure 1). Thus, it appears that nonself-determined EMs are pretty stable over time. Furthermore, trajectory groups were not found to differ significantly in terms of parental, demographic, or academic variables ($ps > .05$). For external regulation, a chi-square analysis indicated that there were more women in the low group and more men in the moderate group, $\chi^2(1, N = 313) = 18.79, p < .05$.

For Identified Regulation, the BIC-based procedure suggested that a two-group model was optimal (see Figure 5). The first group is identified as the decliners group, starting off at T1 with a moderately high level and declining over time (linear trend is significant at $p < .01$), and represents 14.0% of the sample. The second group, representing 85.9% of the sample, is referred to as highs and evidenced constantly high levels over time. These findings contrast with those obtained with the conventional approach (see Figure 1). Whereas the homogeneous perspective suggests that students experience moderately high levels of identified regulation in high school, which decreases slightly in college, the group-based approach suggests that only a subset of students experience a decrease in identified regulation.

We then examined whether these two trajectory groups differ in terms of parental dimensions as well as demographic and academic variables. A MANOVA was performed and was found to be significant, Wilks's $\Lambda(7, 371) = .93, p < .01$. Post-hoc analyses revealed that decliners perceived their parents as less involved and less autonomy supportive than students reporting high levels of identified regulation across measurement times (see Table 4).

Trajectory groups did not differ on demographic and achievement measures. Furthermore, contingency analyses suggested that there tend to be more women reporting high identified regulation, although this effect was marginal, $\chi^2(1, N = 513) = 1.33, p = .06$.

Finally, we examined trajectories of IM (see Figure 6). The BIC-based model selection procedure suggested that a three-group model was the best-fitting solution. The first group, composed of 13.5% of the students, is labeled *decliners* because students in this trajectory group began at T1 with moderate levels of IM but then declined over time. The second group (moderate increasers and 35.6% of the sample) reported levels of IM at T1 that are similar to those of decliners, but, in contrast, they experienced increases over time (linear trend was marginal at $p < .10$). The third group, identified as high increasers (50.9% of students), reported moderately high levels of IM at T1, which progressively increased over time (linear trend was significant at $p < .05$). When comparing these findings with those obtained with the conventional approach, it is possible to relate the general tendency to specific trajectory groups. Hence, the general increase in IM from T1 to T2 might in large part be accounted for by the moderate increasers group, which reveals a similar developmental pattern.

A MANOVA then revealed that these three trajectory groups significantly differ from each other on several variables, Wilks's $\Lambda(14, 740) = .82, p < .01$. Post-hoc analyses suggested that variables such as high school science achievement, parental involvement, and autonomy support can distinguish students in the high increasers trajectory group from those in the moderate increasers and decliners trajectory groups where the former reported the highest levels. Parental variables (involvement and autonomy support) allowed us to distinguish moderate increasers from decliners where the former groups reported higher levels than the latter. Also, trajectory groups differed in terms of achievement level where high increasers reported higher levels of achievement

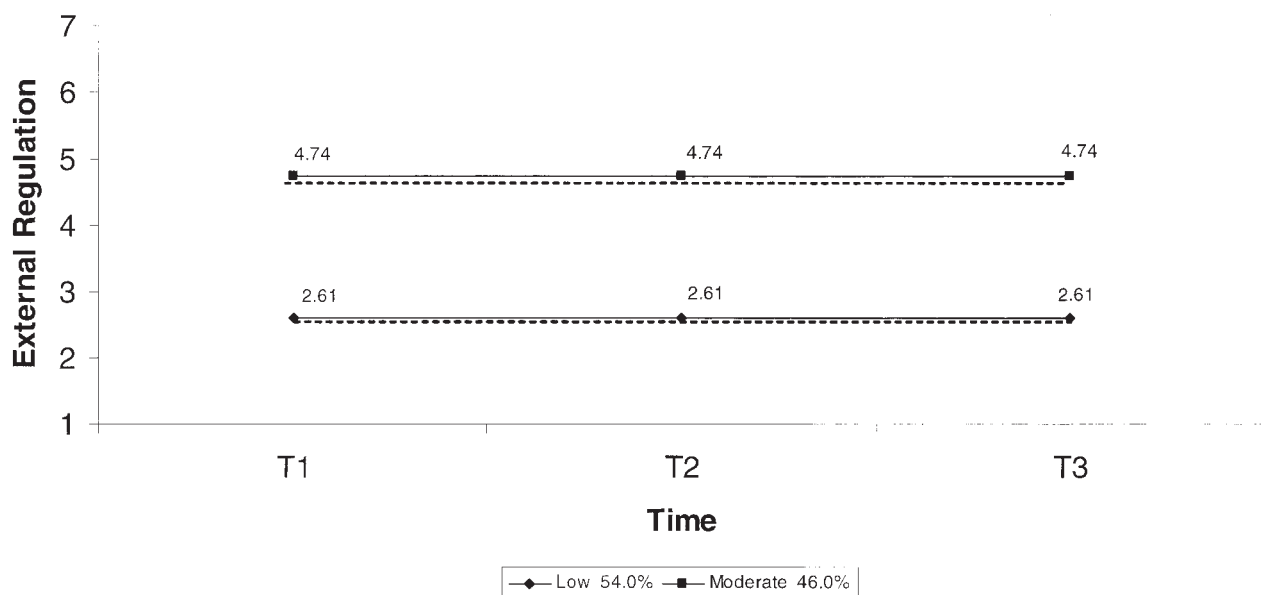


Figure 3. Group-based approach to motivational trajectories: External Regulation. Dotted lines represent predicted trajectories. T1 = Time 1 (end of students' last year of high school); T2 = Time 2 (end of students' first year of college); T3 = Time 3 (end of students' second year of college).

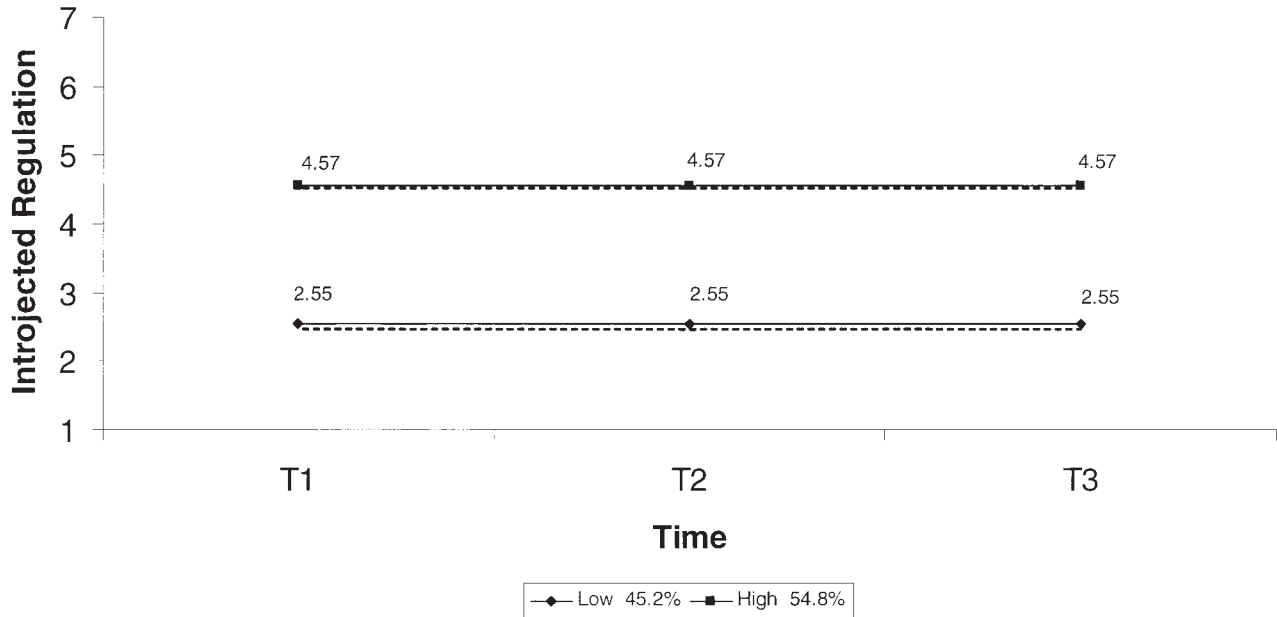


Figure 4. Group-based approach to motivational trajectories: Introjected Regulation. Dotted lines represent predicted trajectories. T1 = Time 1 (end of students' last year of high school); T2 = Time 2 (end of students' first year of college); T3 = Time 3 (end of students' second year of college).

than the moderate increasers. No effect was obtained on demographic measures. Results are presented in Table 5.

Finally, we wished to determine whether students at risk on one dimension are also those at risk on other dimensions. Hence, we computed contingency tables to examine whether students experiencing drops in IM across the transition period were more likely to also be the ones experiencing drops in identified regulation as

well as stable and moderate levels of amotivation, introjection, and external regulation. Indeed, the results suggested that a majority of the students experiencing an undermined identified regulation also experienced undermined IM (32 out of 58 students), $\chi^2(2, N = 513) = 121.74, p < .01$, and stable and moderate levels of amotivation (20 out of 31 students), $\chi^2(2, N = 513) = 89.66, p < .01$. Results were not as clear with introjected and external regu-

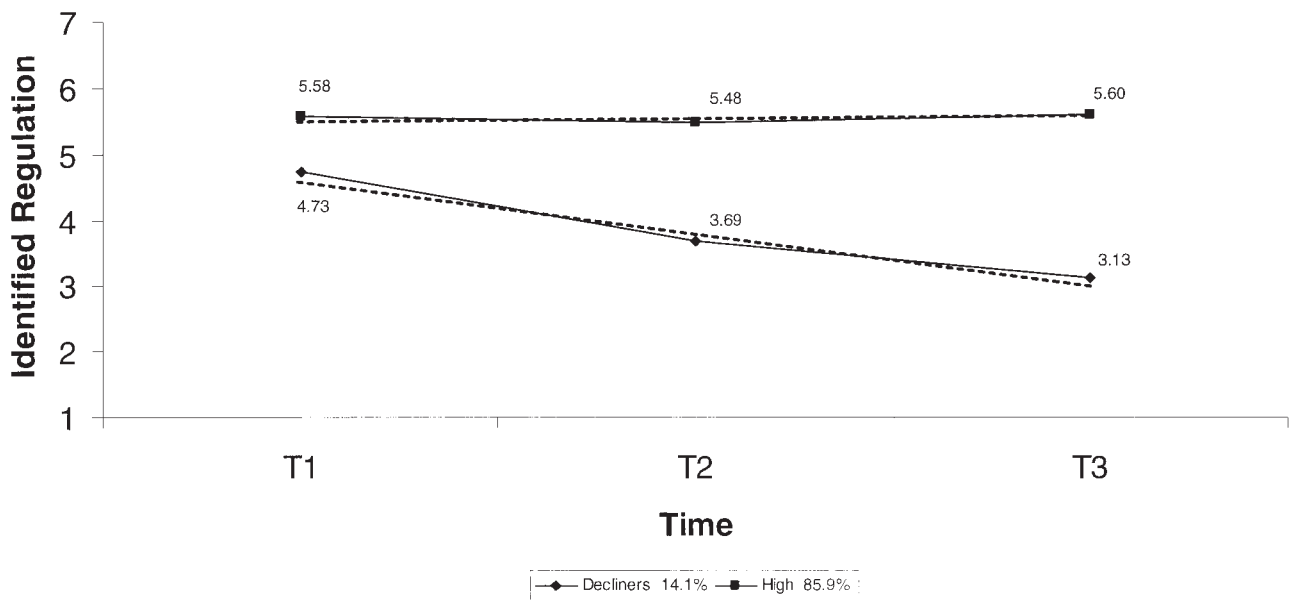


Figure 5. Group-based approach to motivational trajectories: Identified Regulation. Dotted lines represent predicted trajectories. T1 = Time 1 (end of students' last year of high school); T2 = Time 2 (end of students' first year of college); T3 = Time 3 (end of students' second year of college).

Table 4
Comparison of Trajectory Groups on Demographic, Academic, and Familial Variables: Identified Regulation

Variable	Decliners	High	F(1, 377)	ES
Achievement in science	4.15	4.38	1.11	.00
Family income	3.34	3.44	0.18	.00
Parents' education level	4.73	4.70	0.05	.00
Parental involvement	3.82	4.26	23.46**	.06
Parental autonomy support	4.09	4.39	10.75**	.03

Note. ES = effect size.
 ** $p < .01$.

lations. Nevertheless, it is possible to identify an at-risk profile in which students experience decrements in self-determined forms of motivation as well as constant amotivation and a parental context characterized by little involvement and autonomy support.

Discussion

Research findings on school transitions reveal how such a stressful event can undermine academic motivation and competence (Fredericks & Eccles, 2002). However, as stated earlier, it seems that not all students are affected by this transition in the same way (as the conventional approach would suggest). Only a subset of students appears to experience difficulty during this period. The goal of the present study was to examine trajectories of academic motivations during a school transition from the theoretical standpoint of SDT (Deci & Ryan, 1985, 1991, 2000) using a semiparametric, group-based approach to developmental trajectories (Nagin, 1999). Specifically, the key issue was to determine whether all students show similar motivational profiles during a

transition or whether motivational styles fluctuate over time homogeneously. In addition, we wanted to examine whether parental involvement and autonomy support would protect students against the negative effects of a school transition.

The results obtained in this study underscore at least three important points. First, the conclusions derived from using a conventional approach to motivational trajectories neglect an important reality: Only a small group of students who go through a school transition experience motivational difficulties. Results obtained with the conventional approach suggest that transition does not constitute a genuine motivational threat and, in fact, might be a positive event (increased IM, decreased external and introjected regulations), except perhaps for identified regulation. We found that, in contrast to previous findings obtained by Eccles and her colleagues (see Wigfield & Eccles, 2000), IM increased over time. This finding may be due to the difference in how IM is conceptualized (Eccles's conceptualization corresponds to our conceptualization of identified regulation) as well as the fact that our sample is undergoing a transition to college, not high school. In contrast to the transition to high school, the transition to college entails a decrease in teacher control with respect to class management and attendance. Hence, such a change in educational context can enhance students' perception that they are at the origin of their own behavior. On the other hand, the group-based approach allows the identification of a minority of students (at most 14%) who are at risk of experiencing motivational problems. Although they are not numerous, these students will experience steady, moderate levels of amotivation as well as an undermining of their IM and identified regulation. Hence, our findings provide a window to the complexity of motivational processes by showing how motivation might not always develop homogeneously. Such findings are consistent with previous research that has examined group differences

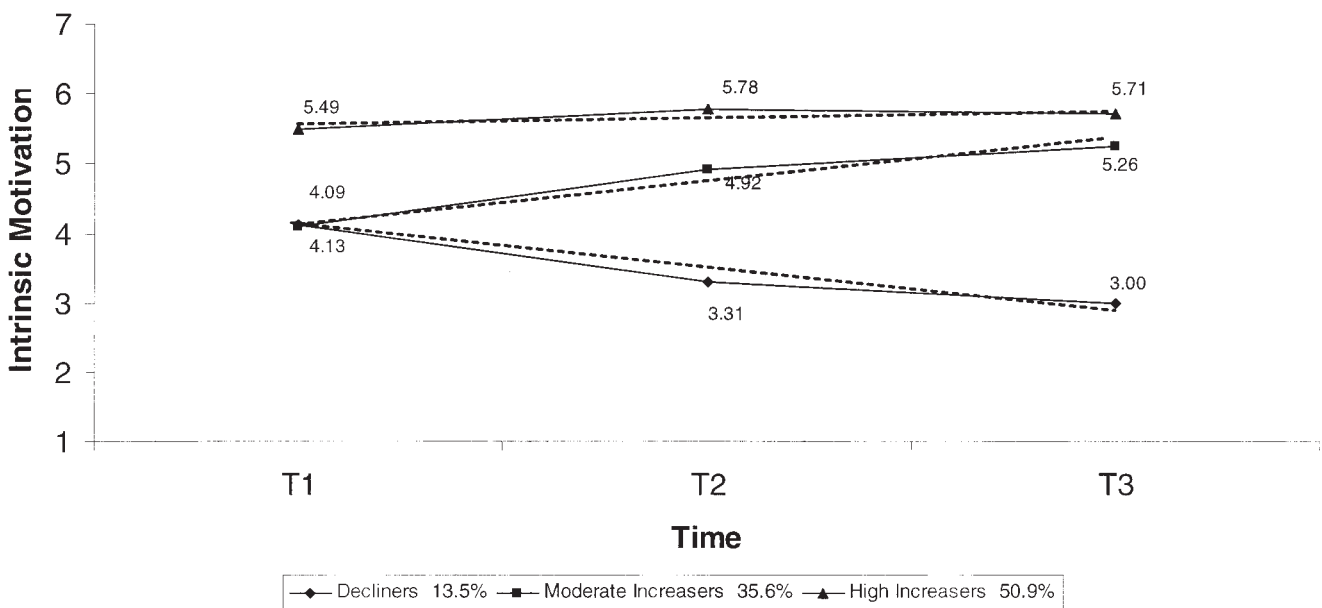


Figure 6. Group-based approach to motivational trajectories: Intrinsic Motivation. Dotted lines represent predicted trajectories. T1 = Time 1 (end of students' last year of high school); T2 = Time 2 (end of students' first year of college); T3 = Time 3 (end of students' second year of college).

Table 5
Comparison of Trajectory Groups on Demographic, Academic, and Familial Variables: Intrinsic Motivation

Variable	Decliners	Moderate increasers	High increasers	<i>F</i> (2, 376)	ES
Achievement in science	4.30 _{a,b}	4.09 _b	4.54 _a	4.58**	.02
Family income	3.75	3.36	3.40	1.20	.01
Parents' education level	4.83	4.63	4.72	0.85	.00
Parental involvement	3.95 _a	4.12 _a	4.33 _b	10.99**	.06
Parental autonomy support	4.09 _a	4.33 _b	4.42 _b	6.72**	.03

Note. For each dependent variable, means having the same subscript are not significantly different at $p < .01$ in the Tukey honestly significant difference comparison. ES = effect size.

** $p < .01$.

in studying motivational trajectories (e.g., Anderman et al., 1999; Eccles et al., 1989; Fredericks & Eccles, 2002; Harter et al., 1992; Midgley et al., 1989; Roeser et al., 1999), although they are derived from an approach that has more ecological validity than previous ones. Indeed, as reported in the introduction, previous research that examined motivational trajectories has used artificially created groups, which might share characteristics on some covariable such as ability but do not necessarily have the same motivational profile.

Second, our findings suggest that parents can ward off the motivational risk associated with a school transition because parental involvement and autonomy support were highest in the most self-determined motivational trajectories. This finding is in line with previous research and theories (e.g., Connell & Wellborn, 1991; Eccles et al., 1993; Eccles [Parsons] et al., 1983) that have proposed that parents can influence student motivational processes. According to SDT (Deci & Ryan, 1985, 1991, 2000), individuals have psychological needs that must be satisfied in order for them to develop and thrive as healthy beings. Parents represent important social agents who can promote the satisfaction of their children's needs. Such issues require that they be addressed daily; however, in stressful contexts such as that provided by a school transition, the availability and support of parents take on added significance. Our findings suggest that students whose parents are not responsive to their psychological needs during transition are put at motivational risk. That is, students from uninvolved and controlling families are more likely to be amotivated and to become less intrinsically motivated and identified with their program. Hence, it would appear that family variables could help predict the unfolding of motivational trajectories. These findings suggest that variations in family dynamics are not only associated with immediate differences in student experience (see Grolnick, 2003) but might also predict different academic paths, even for young adults.

Finally, our findings have implications for SDT (Deci & Ryan, 1985, 1991, 2000), especially with respect to the stability of motivational styles. On measures of external and introjected regulations, we found remarkable stability throughout the 3-year period we surveyed. These findings suggest that once individuals reach a certain level, individual or environmental variables may have little influence on these regulatory styles. This stability suggests that these forms of self-regulation may be related more to personality variables than to other forms of regulation. If such is the case, then it becomes important to understand how individuals

reached this level (which variables were involved) as well as how these determining forces could be tempered so as to reduce the level of nonself-determined EMs and, instead, foster more self-determined forms of motivation. Moreover, our findings suggest that amotivation and self-determined motivations are more prone to fluctuations and possibly more responsive to personal or environmental influences. Hence, providing students with the appropriate familial context (high involvement and autonomy support) appears to be the most successful strategy to efficiently promote self-determined regulatory styles in school.

Despite the innovative and appealing nature of the present findings, when interpreting them, it is important to take into account the methodological limitations inherent to this study. First, the measures included in this study were self-reported, which make them prone to personal bias. A second limitation pertains to the generalizability of our findings. Because our final sample included only a portion of the initial participants, it is possible that our findings do not apply to the rest of the original sample. Moreover, it is possible that our initial sample was not representative of the general student population. For these reasons, replication of our findings is needed. Related to the issue of generalizability is the fact that motivation was measured with respect to the program in general instead of focusing on a specific content area (e.g., math, science, etc.). We thus cannot conclude that the motivational profile obtained can be generalized across academic disciplines. A third limitation has to do with the fact that parental dimensions were not assessed prior to measures of motivations. As a result, we should not interpret our findings as indicating that parental involvement and autonomy support predicts motivational trajectories. Rather, our analyses were aimed at describing the different parental environments reported by individuals in each trajectory group. Finally, it is important to consider the limitations attributable to the group-based statistical approach to developmental trajectories (e.g., does not account for measurement error; see Nagin, 1999) as well as the correlational nature of the present findings.

In conclusion, the present study proposed an innovative approach to studying motivational trajectories during transition. Such an approach can promote a better understanding of how motivational styles unfold over time as well as of the family factors that might contribute to these various motivational profiles. Future motivational research should thus be attentive to the importance of using a conventional versus group-based approach with respect to the type of conclusions that can be drawn. With respect to educa-

tional practice, getting parents involved and teaching them how to be autonomy supportive might turn out to be quite beneficial to protect students against the negative effects of a school transition.

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