



Predicting change in high school motivation profiles: the role of parenting practices

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Abstract

Changes in school motivation have been studied primarily as an average trend that applies uniformly to all high school students. This approach overshadows individual transitions between motivation patterns, and it does not allow for the identification of factors predicting these transitions. In this study, we tracked over a one-year period the stability of three previously identified motivation profiles (“high quantity,” “moderately motivated,” “poor quality”) in two cultural contexts (Canada, Belgium). We also explored the role of parenting practices in predicting transitions to a better or less adaptive profile. A sample of 435 Canadian ($M_{\text{Age}} = 15.85$ y.o.) and 414 Belgian adolescents ($M_{\text{Age}} = 15.19$ y.o.) completed self-report measures on motivation and parent–child relationships at two time points, one year apart. Latent transition analysis indicated that the “poor quality” profile was the least stable in both samples (52.3–68.3% of stability) compared to the “moderately motivated” (72.3–73.5%) and the “high quantity” profiles (66.9–80.3%). Mover-stayer analysis showed that 66.8–73.3% of participants remained in the same profile, 16.0–19.0% moved toward a more adaptive profile, and 10.6–14.3% transitioned into a less adaptive profile. A rise in need-supportive parenting practices (autonomy support, interpersonal involvement, parental structure) predicted students’ shifts to more adaptive profiles. The large amount of stability found suggests that motivation patterns are already largely crystallized in high school, but positive changes among the less motivated students remain possible given the greater malleability of their motivation patterns. Promoting need-supportive parenting practices seems a promising strategy in achieving this objective.

Keywords Academic achievement motivation · High school students · Longitudinal studies · Parenting · Self-determination

An alarming Gallup survey conducted among almost 1 million U.S. students from Grade 5 to Grade 12 reveals that about 33% of high school students were considered as not engaged, and another 33% were considered as actively disengaged from their studies (Gallup, 2017). Worryingly, this survey shows that the closer students get to graduating from high school, the less enthusiastic they feel about school.

Students who lack motivation are at risk of experiencing poor school engagement, which can lead to school dropout and subsequent dramatic individual and social consequences (e.g., lower annual income, higher unemployment risk, loss of tax revenue, shortages of skilled labour; PRÉCA, 2016). Understanding ways to support the development of healthy motivation should be a priority.

The upper secondary grades constitute a pivotal time window to examine motivation given that out-of-school rate jumps from about 1% in lower secondary school age to about 10% in upper secondary school age among high-income countries (UNESCO, 2019). Thus, it seems to be an ideal period to operate positive changes in school motivation, and it is crucial to identify the predictors of changes in motivation at that age. In this study, guided by self-determination theory (SDT), we investigated shifts in high school students’ motivation profiles over one year, and we examined whether those results were replicated among Canadian and Belgian

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adolescents. Further, we sought to identify parenting practices predicting such changes.

Theoretical framework: Motivation as a dynamic, multidimensional and socially-anchored construct

Understanding the development of motivation and tracking its evolution during high school years are crucial steps to foster student engagement until graduation, but it is a complex task to achieve. The first methodological challenge in studying motivation is that it varies over time. According to SDT, motivation is not fixed; rather, it fluctuates through a dynamic process that is constantly evolving throughout the educational path and in response to changes in other areas of life (Ryan & Deci, 2020).

The second challenge in studying motivation is that the pursuit of learning draws on several types of motivation working together. Failure to account for such multidimensionality may result in an inaccurate estimation of students' motivational trajectories. As a multidimensional approach, SDT distinguishes among seven types of academic motivation that can be grouped into three overarching categories: intrinsic motivation, extrinsic motivation, and amotivation (Ryan & Deci, 2020).

Intrinsic motivation includes engagement in an activity for which an individual has an inherent interest and a sense of enjoyment. Three forms of intrinsic motivation are distinguished by the Tripartite Model of Intrinsic Motivation (Carbonneau et al., 2012): *intrinsic motivation to know* (taking pleasure in discovering new knowledge), *intrinsic motivation to accomplish* (gratification from making efforts to improve one's ability to accomplish academic work), and *intrinsic motivation to experience stimulation* (satisfaction from being intellectually stimulated).

In contrast, extrinsic motivation occurs when an individual performs a task for instrumental reasons or because of external demands (Ryan & Deci, 2020). Three types of regulation fall under extrinsic motivation, each with a different level of volition. First, *identified motivation* arises when someone performs an activity by choice based on what they consider important, after internalization of external values. Second, in *introjected regulation*, students engage in academic activities after having partially internalized its value. Their behavior may still represent a way to escape unpleasant feelings (e.g., guilt, anxiety). Finally, *external regulation* occurs when actions are undertaken to satisfy external requirements, avoid sanctions, or obtain benefits (Ryan & Deci, 2020).

Lastly, *amotivation* is a category that differs from intrinsic and extrinsic motivation due to its unidimensional nature.

This concept refers to the absence of motivation to participate in school-related activities (Ryan & Deci, 2020).

A third challenge in studying motivation is the fact that the development of motivation is a social process. From a self-determination perspective, the social environment is a crucial factor in facilitating or undermining motivation through the satisfaction or the thwarting of basic psychological needs (Ryan & Deci, 2020). Consequently, school motivation should be situated in a larger context when investigated empirically. This is a necessary step to allow for the identification of factors that support or hinder the quality of school motivation.

As will be discussed in the next section, very few studies have addressed these three challenges in a single study. The current study aims to meet this objective.

Literature review

Adolescents' school motivation profiles and their stability over time

Recently, studies have increasingly adopted a multidimensional lens to investigate school motivation by determining how multiple types of motivation combine into clusters or profiles among adolescents. Synthetizing this extensive literature is beyond the scope of this paper which mainly focusses on changes in motivation profiles over time. However, a brief overview of the main findings regarding adolescents' school motivation profiles from past studies guided by SDT is necessary to contextualize the present study.

To put it simply, school motivation profiles have mostly been classified based on the typology proposed by Vansteenkiste et al. (2009), even though the specific labels have varied across studies. The six profiles are presented in decreasing order of motivational quality based on the assumption that intrinsic motivation is of greater quality than extrinsic motivation (Ryan & Deci, 2020). A "good quality" profile (high intrinsic/low extrinsic) has been identified in six studies; a "high quantity" profile (high intrinsic and extrinsic) in eight studies, a "moderately motivated" profile (moderate intrinsic and moderately high extrinsic) in three studies, a "low quantity" profile (low intrinsic and extrinsic) in six studies, a "poor quality" profile (low intrinsic/high extrinsic) in eight studies, and an "amotivated" profile (very low intrinsic and extrinsic) in one study (Petit et al., 2022; Hayenga & Corpus, 2010; Manzano-Sánchez et al., 2021; Ratelle et al., 2007; Vansteenkiste et al., 2009; Wormington et al., 2012; Xie et al., 2022; Zhang & Lin, 2020). Table 1 details the profiles found in each study as well as the specific labels of profile.

While the research investigating school motivation from a multidimensional perspective is growing, studies tracking how motivation profiles evolve over time remain scarce. Most of the

Table 1 Classification of adolescents' motivation profiles based on SDT found in previous studies

Studies	Motivation profiles					
	Good quality	High quantity	Moderately motivated	Low quantity	Poor quality	Amotivated
Hayenga & Corpus, 2010		X	X		X	
Manzano-Sánchez et al., 2021	X	X		X	X	
Petit et al., 2022	X (High quality)	X		X	X (Low quality)	
Ratelle et al., 2007		X (High autonomous & controlled)	X (Moderate autonomous & controlled)		X (Controlled)	
Vansteenkiste et al., 2009	X	X		X	X	
Wormington et al., 2012	X	X		X (Low quantity with poor quality)	X	
Xie et al., 2022	X (Autonomously motivated)	X (Balanced motivated)	X	X (Balanced demotivated)	X (Externally regulated)	X
Zhang & Lin, 2020	X	X		X	X	

The specific name of profiles is indicated in parentheses when labels differ from the most common terminology

existing literature on the evolution of motivation are based on variable-centered studies. These studies have generally documented a decline in intrinsic motivation from the end of primary school and across middle and high school years (Gillet et al., 2012; Gnamb & Hanfstingl, 2016; Nishimura & Sakurai, 2017), although Gillet et al. (2012) reported an increase in intrinsic motivation at the end of high school, around the age of 16 years old. Longitudinal, variable-centered studies are useful to capture the average levels of motivation over time, but this analytical strategy is based on the assumption that the motivational trend applies to high school students in general. Therefore, such studies overshadow individual trajectories of motivation, which may differ from the overall tendency.

In support of this idea, recent research suggests that high schoolers follow various trajectories of motivation, such that tailored strategies and interventions are needed to suit a diversity of subpopulations. Specifically, Guay et al. (2021) have identified five latent motivational trajectories: three stable trajectories (from low to high levels), one increasing trajectory, and one high trajectory with fluctuations over time. Although it has proven useful in identifying different trajectories of motivation that differ from the general downward trend, this study did not take into account the fact that motivation is a multifaceted construct because it relied on a global measure of self-determined motivation.

Latent transition analysis (LTA) makes it possible to account for both the multidimensional and dynamic nature of motivation by monitoring the stability of motivation

profiles over time, but studies using LTA are still rare. The two studies we found reported contrasting results (Hayenga & Corpus, 2010; Xie et al., 2022). In fact, they differed with respect to the stability of profile membership, the most stable profile observed, the most volatile profile identified as well as the most likely direction of transition among adolescents who shifted profiles. Hayenga and Corpus (2010) identified “poor quality” as the most stable profile (73.9% of stability) and “high quantity” as the most volatile profile (49.1%). In contrast, “high quantity” came out as the most stable profile (60.0%), and “amotivated” as the least stable profile (23%) in Xie et al. (2022). These numbers show that Hayenga and Corpus found greater stability than Xie and colleagues for most of their profiles. When they transitioned, participants from the Hayenga and Corpus' study were more likely to shift toward a poorer-quality profile while Xie and colleagues found the opposite. The only convergent result between the two studies concerns the fact that transitions occur mainly between adjacent profiles; large positive or negative changes in motivation were rare. Differences in the results could be explained by the distinct time spans of the two studies (one vs two years), the distinct developmental stages examined (middle vs high school), their selection of different types of motivation, and the distinct analytical method used (cluster analysis vs. LTA). Beyond these two studies, other research highlighted moderate to very high levels of stability in motivation profiles specific to mathematics, or in general motivation profiles among younger participants (Lazarides et al., 2019; Tuominen et al., 2020).

To disentangle these conflicting results, further research is needed. In the current study, we examined more closely the stability of the “high quantity”, the “moderately motivated” and the “poor quality” profiles, three patterns that we identified in our previous work (Petit et al., 2022). Determining the most and the least stable profiles and estimating the probability of transitioning toward a more or a less adaptive motivation profile is important to identify students who are at highest risk of experiencing a decline in motivation and who are likely to benefit from an intervention. Further, longitudinal, person-centered studies can inform the development of adapted, personalized teaching and intervention approaches.

Parental predictors of motivation profile transitions

According to SDT, motivational processes should be situated in their larger context because of the influence of environment on the quality of students’ motivation (Ryan & Deci, 2020). One such environment is family. Existing literature showed that adolescents whose parents fulfill their basic psychological needs report higher levels and higher quality of school motivation (Guay et al., 2021; Manzano-Sánchez et al., 2021; Petit et al., 2022). However, most of those studies have failed to capture the dynamic nature of motivational processes. In general, previous studies have assessed parental predictors only once, were more interested in how the overall levels of the predictors (rather than their fluctuations) affect motivation, and have assumed that predictors have an enduring and consistent effect on school motivation over time. It is however important to acknowledge that both motivation and the student’s environment are constantly evolving, especially during adolescence, a time of change in various spheres of youth’s life. For example, a decline in the quality of the parent–child relationship and the levels of parental involvement has been previously observed during adolescence (Keijsers & Poulin, 2013; Xu et al., 2020).

The current study aims at examining whether changes in parenting practices contribute to shifts in motivation profiles. We investigated several parenting dimensions known to be related to motivation and other academic outcomes. More specifically, this study focused on need-supportive parenting practices (i.e., autonomy support, interpersonal involvement, parental structure), parental warmth/rejection, and parental monitoring.

We chose to investigate these three dimensions because according to Gray and Steinberg (1999), they constitute together the core dimensions of authoritative parenting, a type of parenting style that predicts positive outcomes in youth (for a meta-analysis, Pinquart., 2016). However, other authors have argued that these three dimensions should be examined separately, as they may not be equally effective in influencing adolescent well-being, and they are

associated with different types of academic and psychological consequences (Fulton & Turner, 2008; Grolnick, 2016). In fact, Gray and Steinberg (1999) showed that autonomy support and parental warmth were the strongest predictors of academic competence while parental monitoring was the strongest predictor of lower levels of behavior problems.

Need-supportive parenting practices

Need-supportive parenting practices have been considered beneficial for youth’s school motivation because they fulfill their basic psychological needs for relatedness, autonomy, and competence, known to foster their interest and intrinsic motivation (Charlot Colomès et al., 2021; Ryan & Deci, 2020; Soenens et al., 2017). Relatedly, Grolnick et al. (1997) have introduced a tripartite conceptualization of need-supportive parenting practices that include interpersonal involvement, autonomy support, and parental structure. Basic psychological needs of children are supported by parents when they devote resources and time to their children’s life (*interpersonal involvement* dimension), when they guide them in their learning process without coercing them (*autonomy support* dimension), and when they offer them a consistent structure, clear expectations, and constructive criticism (*parental structure* dimension). Findings from previous studies showed that interpersonal involvement, autonomy support, and parental structure were concurrently positively associated with intrinsic motivation and engagement (Farkas & Grolnick, 2010; Feng et al., 2019; Zhou et al., 2019), and was associated to the most adaptive motivation profile (Petit et al., 2022). Conversely, needs frustration negatively predicted intrinsic motivation (Aydin & Michou, 2020).

When examined longitudinally, however, results were inconsistent. In Gnambs and Hanfstingl’s study (2016), satisfaction of the needs for relatedness, autonomy, and competence buffered the decline of youth’s intrinsic motivation, but did not have the power to increase it. In contrast, Guay et al. (2021) reported that students’ relatedness to their father was related to the high-stable motivation trajectory, and that an increase in father-child relatedness predicted a rise in intrinsic motivation levels.

Parental warmth / rejection

Parental warmth is defined by emotional availability, caring, and acceptance, whereas *parental rejection* is characterized by hostility, aggression, indifference, and neglect (Rohner, 2005). Both are important factors that can influence the quality of the parent–child relationship. Warm parents are able to provide emotional safety, which contributes to increasing their children’s self-efficacy and, consequently, facilitates their learning (Fulton & Turner,

2008). In contrast, hostile and neglectful parents make their children's environment stressful and unpredictable—a situation that thwarts their basic psychological needs. Previous variable-centered studies have emphasized relationships between parental warmth and beneficial academic outcomes (i.e., academic achievement, intrinsic motivation, and school engagement; Fulton & Turner, 2008; Józsa et al., 2019; Lowe & Dotterer, 2013; Pinquart, 2016), while parental rejection was linked to maladaptive outcomes (e.g., controlled motivation, school dropout, delinquency, and externalizing problems; Aydın & Michou, 2020; Soenens et al., 2017). In person-centered studies, high levels of parental warmth were found to increase the likelihood of belonging to the high-quantity motivation profile (Litalien et al., 2019; Petit et al., 2022) while parental rejection did not predict motivation profiles (Petit et al., 2022).

Parental monitoring

Parental monitoring is the last fundamental parenting factor that must be taken into account due to its importance in adolescent development. Parental monitoring encompasses diverse behaviors aiming at increasing parental awareness of the activities in which their child is engaging and with whom (Omer et al., 2016; Stattin & Kerr, 2000). By taking action to keep track of their children's whereabouts, parental monitoring contributes to lowering adolescents' maladaptive behaviors (e.g., substance use, delinquency; Villarreal & Nelson, 2018), known to undermine school motivation, engagement, and persistence (Gubbels et al., 2019). A positive relationship between parental monitoring and intrinsic motivation or school engagement has been highlighted in variable-centered studies (Affuso et al., 2022; Lowe & Dotterer, 2013). Parental monitoring was also positively related to a high-quantity motivation profile in a person-centered study (Petit et al., 2022).

In sum, much of the research linking the family context to student motivation has been cross-sectional and variable-centered. Thus, it remains unknown whether an increase (decrease) in parent–child relationship quality has the power to operate positive (negative) changes on students' motivation trajectories. This study is among the first to address empirically such questions using a longitudinal, person-centered design.

The current study

Guided by SDT, this study is a longitudinal extension of our recent work in which three school motivation profiles have been identified in both a Canadian and a Belgian sample. First, the “high quantity” profile was characterized by the highest levels of intrinsic and extrinsic

motivation, and the lowest level of amotivation. Second, the “moderately motivated” profile was characterized by its moderate level of intrinsic motivation, a higher level of extrinsic motivation, and a low level of amotivation. Third, the “poor quality” profile had the lowest level of intrinsic motivation, a moderately high level of extrinsic motivation, and the highest level of amotivation (Petit et al., 2022).

The first aim of this study is to monitor, in both samples, students' intraindividual transitions between motivation profiles over a one-year interval (from Grade 9 to 10, or from Grade 10 to 11), during a critical period as they approach the end of high school. Given the conflicting results found in prior studies regarding the (un)stability of students' profile membership, the most and least stable profile, and the direction of profile shifts, no hypothesis has been formulated for the first objective.

As a second objective, we aimed to identify parental predictors of shifts in motivation profiles. One advantage of having two samples is to test different parental predictors. Based on prior variable-centered and person-centered studies (e.g., Affuso, 2022; Guay et al., 2021; Litalien et al., 2019; Lowe & Dotterer, 2013; Manzano-Sánchez et al., 2021; Petit et al., 2022), we hypothesize that an improvement in need-supportive parenting practices, parental warmth, and monitoring will elicit a shift in favor of a motivation profile of greater quality, while a decrease of such conditions will predict a shift toward a less adaptive profile.

Our data presents several advantages for examining transitions between motivation profiles. First, profiles were identified using latent profile analysis (LPA) rather than the traditional cluster analysis. LPA is a robust probabilistic model providing fit indices to compare several solutions and assess goodness-of-fit while cluster analysis relies on more arbitrary criteria to categorize participants into profiles. Using fit indices increases the likelihood of extracting the appropriate number of profiles (Vermunt & Magidson, 2002). Second, seven types of motivation from the SDT were included in the creation of profiles while previous studies have used fewer types. Third, our three-profile solution has been replicated among Canadian and Belgian high school students, and it offers the opportunity to monitor transitions between motivation profiles in two different cultural contexts. This is particularly important as school environment and cultural values are known to influence motivational processes (Wang et al., 2020). Fourth, the structure and levels of motivation within each profile were found to be invariant at two time points. This means that profile transitions from Wave 1 to Wave 2 will represent true change or true stability of motivation patterns. Finally, the clear ordering in the quality of motivation profiles offers the opportunity to regroup students according to whether they transitioned to a higher quality profile, a lower quality profile, or the same profile.

Method

Participants

Between 2012 and 2015, we recruited two samples of high school students in Grades 9 through 11 from two countries. The first sample (UQAM-teens or *Univers social*, in French) included 435 teenagers from the province of Québec in Canada. They were recruited from two public French-speaking secondary schools situated in underprivileged areas in the suburbs of a major city. The second sample was made up of 414 teenagers from Belgium. Belgian participants were drawn from one public French-speaking secondary school located in a Walloon town.

Table 2 shows that most Canadian participants were female, White, and francophone, and only a minority lived in intact households. The participants in the Belgian sample were largely Belgian-born and most lived in intact families, with girls making up about half of the sample. Over one-third of the Belgian participants were enrolled in a vocational training program. The situation was different among Canadian participants: all of them attended a standard general high school program.

Although the Canadian and Belgian data collections used different numbers of waves and non-identical intervals across data points, they both offered two assessments separated by a one-year interval in the spring, that is, in the last portion of the academic year. A one-year interval between two time points was used in the current analyses. To match the design of the Belgian study, we had to perform various procedures on the Canadian sample, such as a random selection of two consecutive assessments for three-wave participants and the random allocation of single-wave participants to one of the two time points according to their high school level. These manipulations are described in detail in our previous work (Petit et al., 2022).

After these procedures, both the first and the second wave of Canadian data provided 303 participants that were used for analyses. Students from the first time point were either in Grade 9 or 10 (64.4% girls; mean age: 15.82 years old) while those from the second time point were enrolled either in Grade 10 or 11 (70.0% girls; mean age: 16.94 years old). About 56% of the 303 participants are students who provided data for both waves ($n = 171$). The remaining individuals are single-wave participants assigned to one of the two waves. Students who had participated in both waves were significantly older than single-wave participants, $t(301) = 2.328$, $p < 0.05$. Students who participated in both waves also had greater odds of having a father with higher education, $F(1, 231) = 6.045$, $p < 0.05$. No differences were found between single- and two-wave participants regarding gender, family structure, race/ethnicity, native language, and mother's educational level.

For the Belgian sample, 369 students (51.8% girls; mean age: 15.19 years old) participated to the first time point when they were either in Grade 9 or Grade 10. The second time point was composed of 312 participants (51.1% girls; mean age: 16.24 years old) who were mostly in Grades 10 or 11, although a limited number of participants who repeated Grade 9 were also included. Approximately 73% of Wave 1 participants and 86% of Wave 2 participants, or a total of 269 youth, provided accurate data at both waves. Two-wave individuals were younger than single-wave participants, $t(158.785) = 2.343$, $p < 0.05$, but there were no differences in terms of gender, family structure, or country of birth.

Procedure

The study was open to all students enrolled in the selected grades at the participating institutions. Students signed a written consent form and participated voluntarily, as required by the ethics review board of both universities. In addition to the student consent form, parental consent was required for Canadian youth to participate. In the Belgian sample, parents were sent a letter informing them that their child would participate in the study and inviting them to send back a form in case of refusal. A self-reported questionnaire on the topics of family and academics was administered to participating students. Canadian adolescents were asked to fill out an online questionnaire lasting approximately 75 min, and Belgian participants had a paper questionnaire lasting 50 min. Information was gathered at the school for both waves of data and both samples.

Measures

We detail below the common measures used in both samples, and the measures specific to the Canadian and the Belgian samples. All measures were assessed at two time points.

Measures common to the Canadian and Belgian samples

School motivation In both samples, this variable was measured using the French version of the validated Academic Motivation Scale (AMS; Vallerand et al., 1989). It consisted of a 3-dimensional scale instrument based on 28 items spread across 7 subscales. Each subscale included four items which represented possible responses to the question “*Why do you attend high school?*” The first dimension assessed three forms of intrinsic motivation: Intrinsic Motivation for Knowledge (e.g., “*For the pleasure I experience when I discover new things never seen before,*” $\omega = 0.85\text{--}0.89$), Intrinsic Motivation for Accomplishment (e.g., “*For the satisfaction I feel when I am in the process of accomplishing difficult academic activities,*” $\omega = 0.80\text{--}0.88$), and Intrinsic

Table 2 Sociodemographic characteristics of Canadian and Belgian samples at Wave 1 and Wave 2

	Canadian sample		Belgian sample	
	Wave 1 (n=303)	Wave 2 (n=303)	Wave 1 (n=369)	Wave 2 (n=311)
	% / mean (SD)			
Gender^a				
Boy	35.6	30.0	48.0	45.7
Girl	64.4	70.0	51.8	51.1
Age (mean [SD])	15.85 (.84)	16.94 (.63)	15.19 (.96)	16.24 (.94)
High school level^a				
Grade 9	64.0		54.7	5.5 ^b
Grade 10	36.0	37.6	45.3	55.0
Grade 11		62.4		36.3
High school program^a				
General secondary education	100.0	100.0	61.0	56.6
Technical or vocational secondary education	0.0	0.0	39.0	39.9
Race^a				
White	64.0	62.0		
Other	32.0	36.0		
Country of birth^a				
Belgium			92.4	92.3
Other			7.0	4.2
Native language^a				
French	80.5	78.2		
Other	18.2	20.8		
Family structure^a				
Parents still together (CND) Living with both parents (BLG)	46.5	46.2	64.2	57.9
Other	52.5	52.8	35.2	37.3
Mother's level of education^a				
High school or less	29.4	25.7		
College	17.8	30.0		
University	26.4	34.0		
Don't know	18.5	8.9		
Father's level of education^a				
High school or less	31.0	28.4		
College	15.8	17.8		
University	29.4	35.6		
Don't know	22.4	16.5		

This table has been presented in a previous manuscript (Petit et al., 2022)

^aSum of categories may be lower than 100% due to missing values. ^b This percentage reflects grade repeaters in the Belgian sample. Grade repeaters in the Canadian sample were lost in the second wave. CND = Canada. BLG = Belgium

Motivation for Stimulation (e.g., “*Because I really like going to school,*” $\omega = 0.75\text{--}0.84$). The second dimension measured three forms of extrinsic motivation: Identified Regulation (e.g., “*Because this will help me make a better choice regarding my career orientation,*” $\omega = 0.75\text{--}0.83$), Introjected Regulation (e.g., “*Because I want to show myself*

that I can succeed in my studies,” $\omega = 0.83\text{--}0.89$), and External Regulation (e.g., “*In order to have a better salary later on,*” $\omega = 0.59\text{--}0.83$). The final dimension evaluated amotivation (e.g., “*I can't see why I go to school and frankly, I couldn't care less,*” $\omega = 0.82\text{--}0.85$). Response choices for each item were rated on a 4-point Likert scale from 0

(*strongly disagree*) to 3 (*strongly agree*) for the Canadian sample, and on a 5-point Likert scale from 0 (*strongly disagree*) to 4 (*strongly agree*) for the Belgian sample. In order to get the same range of values as in the Canadian sample, responses from Belgian participants were recoded in the following way: 0=0; 1=0.75; 2=1.5; 3=2.25; 4=3. We averaged each subscale's items.

Sociodemographic characteristics We controlled for sociodemographic variables assessed in both samples, that is, gender, age (Canada: age calculated with date of birth; Belgium: self-reported age) and family situation (Canada: [0] both parents living together, [1] parents divorced/separated/other; Belgium: [0] living with both parents, [1] living with one parent/other).

Parental measures specific to the Canadian sample

Parental acceptance / rejection The French version of the Parental Acceptance-Rejection Questionnaire – Short Form (Child PARQ-SF; Rohner, 2005) was used to assess students' perceptions of their primary caregiver's accepting-rejecting behaviors. The validated 24-item instrument measured one form of parental acceptance (i.e., Warmth/Affection; 8 items; e.g., “Gives me a lot of attention”; $\omega = 0.87$) as well as three forms of parental rejection: Hostility/Aggression (6 items; e.g., “Frightens or threatens me when I do something wrong”; $\omega = 0.80-0.82$), Indifference/Neglect (6 items; e.g., “Pays no attention when I asked for help”; $\omega = 0.80-0.83$), and Undifferentiated Rejection (4 items; e.g., “Seems to dislike me”; $\omega = 0.79-0.83$). Participants answered on a 4-point Likert scale ranging from 1 (*always false*) to 4 (*always true*). By adding the corresponding items, a score of parental warmth/affection ($\omega = 0.87$) and a score of parental hostility, neglect, and rejection ($\omega = 0.91-0.93$) were obtained.

Parental monitoring A 17-item scale developed by Stattin and Kerr (2000) and translated into French by Keijsers and Poulin (2013) was used to assess parental monitoring. Six items evaluated how well parents were aware of their children's location, activities, and friends (e.g., “Do your parents know the friends with whom you hang out during your free time?”), four items measured parental solicitation (e.g., “How often do your parents ask you what happened during your free time?”), three items examined youth disclosure to parents (e.g., “Do you like to tell your parents what you did and where you went during the evening?”), and four items assessed parental control (e.g., “If you go out on a Saturday evening, do you have to inform your parents beforehand?”). Participants answered on a 4-point Likert scale from 1 (*never*) to 4 (*always*). A total score summing all items was used ($\omega = 0.85$).

Parental measures specific to the Belgian sample

Need-supportive parenting practices The French version of the Interpersonal Behavior Scale was used to measure students' perceptions of how their parents help them satisfy their basic psychological needs (Otis & Pelletier, 2000). This scale consists of 21 items and evaluates three need-supportive parenting practices: autonomy support (6 items; $\omega = 0.71-0.84$; e.g., “My parents openly consider my thoughts and feelings even though they are different from their own”), parental structure (10 items; $\omega = 0.76-0.87$; e.g., “My parents give me helpful suggestions on how I can improve”), and interpersonal involvement (5 items; $\omega = 0.81-0.88$; e.g., “I feel that my parents really care about me”). Responses were given on a 7-point Likert scale ranging from 1 (*never*) to 7 (*always*). Items of each subscale were averaged.

Statistical strategy

Analyses performed in the present study follow and extend those arising from a prior study in which three profiles of school motivation emerged in the Canadian and Belgian samples across two consecutive school years. Description of the profiles (i.e., “poor quality”, “moderately motivated”, and “high quantity”), provision of fit indices, and comparisons of profiles cross-nationally and across time points can be found in Petit et al. (2022). Based on these profiles, we conducted latent transition analysis (LTA) and mover-stayer LTA using Mplus 8.4 to (a) investigate changes in adolescents' school motivation profile membership over one year, and (b) identify antecedents of profile transitions. LTA is a longitudinal extension of latent profile analysis (LPA) that simultaneously estimates latent profiles at multiple time points as well as profile transition between time points (i.e., transition probabilities; for a description, see Nylund, 2007). The LTA model highlights change over time using variables that are not directly observed (i.e., latent). LTA is also an autoregressive model considering that one's probability of being in a particular profile is conditional on profile membership from the previous measurement time.

A mover-stayer model is a specific type of LTA. It uses a second-order latent profile variable that directly influences profile membership at each time point while moderating the autoregressive linkage between data waves. Although both LTA and mover-stayer models aim at examining stability and change in profile membership over time, traditional LTA assumes that a single model fits the sample drawn from the population. In contrast, mover-stayer LTA postulates various population subgroups with varying status change profiles (e.g., “mover”, “stayer”). By capturing unobserved heterogeneity in the transition probabilities, mover-stayer LTA produces more precise estimates than

traditional LTA (Nylund, 2007). In the current study, the mover-stayer latent variable was used to identify three subgroups. Participants who, according to our estimations, progressed to more highly motivated profiles one year after the baseline assessment (i.e., from “poor quality” to “moderately motivated” or “high quantity”; from “moderately motivated” to “high quantity”) were classified as “mover up”. Participants who regressed to less motivated profiles (i.e., from “high quantity” to “moderately motivated” or “poor quality”; from “moderately motivated” to “poor quality”) were classified as “mover down”. Finally, participants who remained in the same profile during both waves were identified as “stayer”.

Figure 1 illustrates the mover-stayer LTA model tested separately in the Canadian and Belgian samples. First, LTA was performed to estimate adolescents’ probabilities of transitioning across motivation profiles between two consecutive years. To do so, we included in the same model the seven indicators of motivation measured at two time points. We compared the three-profile LTA solution with the two-profile and the four-profile LTA solutions in both samples to confirm that the three-profile solution found at each time point in our previous paper (Petit et al., 2022) also applied when motivation indicators at both two time points are included in the same LTA model. Next, we tested the longitudinal measurement invariance of the best fitting LTA solution.

In the second step, mover-stayer LTA was conducted to determine adolescents’ probabilities of moving up, moving down, or staying in the same profile between two consecutive years. To this end, for the “mover up”, we constrained the probability of moving down or staying in the same profile to zero, while upward movements were estimated freely. For the “mover down”, we constrained the probability of staying in the same profile or moving to a more highly motivated profile to zero, while downward movements were estimated freely. For the “stayer”, we fixed the probability of changing profiles to zero, and we constrained the probability of remaining in the same profile to one.

In the third step, time-varying predictors (i.e., parental practices) were added separately as predictors of the mover-stayer latent variable while adjusting for time-invariant sociodemographic variables common to both samples (i.e., gender, age, family structure). For time-invariant variables, baseline scores were used, except for participants who participated only in Wave 2. When participant’s age was available only at Wave 2, we subtracted the average interval between the two data collection time points from the age at Wave 2. For time-varying predictors, rather than adding separate scores of each measurement time to the model, we computed the difference between the scores obtained at both waves to avoid multicollinearity and limit the number of variables entered in the model.

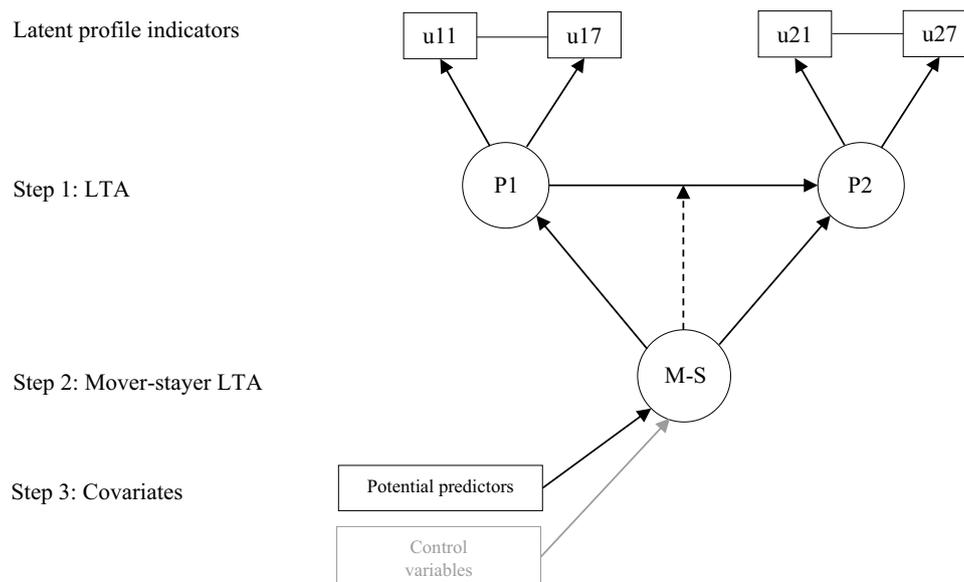


Fig. 1 Mover-stayer LTA model tested in the Canadian and Belgian samples. Note. Rectangles represent observed variables and circles represent latent unobserved variables. u11-u17 refer to the seven motivation indicators of latent profiles (i.e., intrinsic motivation to know, intrinsic motivation to accomplish, intrinsic motivation to experience stimulation, identified regulation, introjected regulation, external regulation, amotivation) measured at Wave 1 while u21-u27 refer to the same motivation indicators measured at Wave 2. P1

and P2 refer to the school motivation latent profiles found at Wave 1 and Wave 2, respectively (see Petit et al., 2022). M-S represents the mover-stayer latent variable. Potential parental predictors of the mover-stayer latent variable, examined separately, include need-supportive parenting practices (autonomy support, parental structure, interpersonal involvement), parental acceptance/rejection and parental monitoring. Sociodemographics were included as control variables (i.e., gender, age, family structure)

Full information maximum likelihood (FIML), a feature of Mplus 8.4, was used to manage missing data on school motivation indicators, while multiple imputations were used to address missing data on predictors and control variables. For each sample, thirty imputed data sets were created.

Results

LTA model and transition probabilities

Comparisons of the 2-, 3-, and 4-profile LTA models confirmed that in this longitudinal model, the 3-profile LTA solution still best represented the data in both the Canadian and Belgian samples. As shown in the first part of Table 3, the 3-profile LTA model in both samples presented lower values on all fit indices examined (i.e., Bayesian Information Criterion [BIC], Sample-size Adjusted BIC [SABIC], Akaike Information Criterion [AIC]) than the 2-profile LTA model, while the 4-profile LTA model was not replicated or identified. Lower values on fit indices are indicative of better fit and model parsimony.

Next, we tested longitudinal measurement invariance by comparing fit indices of the unconstrained 3-profile LTA model with the invariant 3-profile LTA model in which indicators' mean were constrained to be equal in both time points. The invariant model displayed lower BIC, SABIC and AIC values than the unconstrained 3-profile LTA model (see lower part of Table 3). This suggests that stable motivation profiles over time best represented our data in both waves, and that profiles have the same meaning in both waves.

The invariant 3-profile LTA model exhibited three motivation profiles that were similar at both times points in the Canadian and the Belgian samples, namely the “poor quality” profile, the “moderately motivated” profile, and the “high quantity” profile. The profiles are illustrated in Fig. 2. Note that the profiles in the current study were slightly

different from those presented in our previous study (Petit et al., 2022). In the current study, we constrained the Canadian and the Belgian profiles to be invariant between the two time points. In the former study, we tested the similarity of Canadian and Belgian profiles at each time point; no model constraints were applied across time points. However, the meaning and interpretation of profiles in both studies are similar. Detailed description of the profiles can be found in Petit et al. (2022).

Table 4 displays the proportions of students in each profile in Wave 1 and Wave 2 as well as the transition probability matrix. About one out of five Canadian and Belgian students were in the “poor quality” profile (from 16.5% to 22.6% according to the samples and the time points), about half of the students were in the “moderately motivated” profiles (from 48.4% to 53.2%), and about three out of ten students were in the “high quantity” profile (from 26.0% to 30.7%). The matrix revealed that most Canadian and Belgian adolescents remained in the same profile over a one-year period, as illustrated by the greatest probabilities on the diagonal. Membership in the “poor quality” profile was less stable over time, with probabilities of staying in the same profile varying from 52.7% to 68.3% across the Canadian and Belgian samples. In contrast, the “moderately motivated” and the “high quantity” profiles tended to be more stable over time, with probabilities varying from 66.9% to 80.3%. Off-diagonal probabilities in the matrix reflect the transition from a particular profile in Wave 1 to a different profile in Wave 2. Probabilities below the diagonal represent downward movements and probabilities above the diagonal represent upward movements. In both samples, transitioning from the “poor quality” to the “moderately motivated” profiles was the most prevalent upward transition, with probabilities varying from 27.0% to 41.9%. Transitioning from the “high quantity” to the “moderately motivated” profiles was the most prevalent downward transition, with probabilities varying from 19.7% to 27.6%. Transitions between extreme profiles (i.e., from

Table 3 Comparisons of information criteria for latent transition models among Canadian and Belgian samples

	Canadian sample			Belgian sample		
	BIC	SABIC	AIC	BIC	SABIC	AIC
Comparisons of iterative LTA models (unconstrained)						
2-profile LTA	7870.57	7727.76	7687.18	8803.31	8660.51	8622.15
3-profile LTA	7515.36	7312.26	7254.54	8423.89	8220.80	8166.23
4-profile LTA	Model not replicated			Model not identified		
Comparisons of measurement invariance						
3-profile LTA—unconstrained	7515.36	7312.26	7254.54	8423.89	8220.80	8166.23
3-profile LTA—invariant	7419.85	7283.19	7244.61	8315.92	8179.47	8142.81

Lines in bold reflect best-fitting solutions. *BIC* Bayesian information criterion; *SABIC* Sample-size Bayesian information criterion; *AIC* Akaike information criterion

Fig. 2 Profiles of academic motivation in Canadian and Belgian samples at both waves. Note. IM = Intrinsic motivation. EM = Extrinsic motivation.

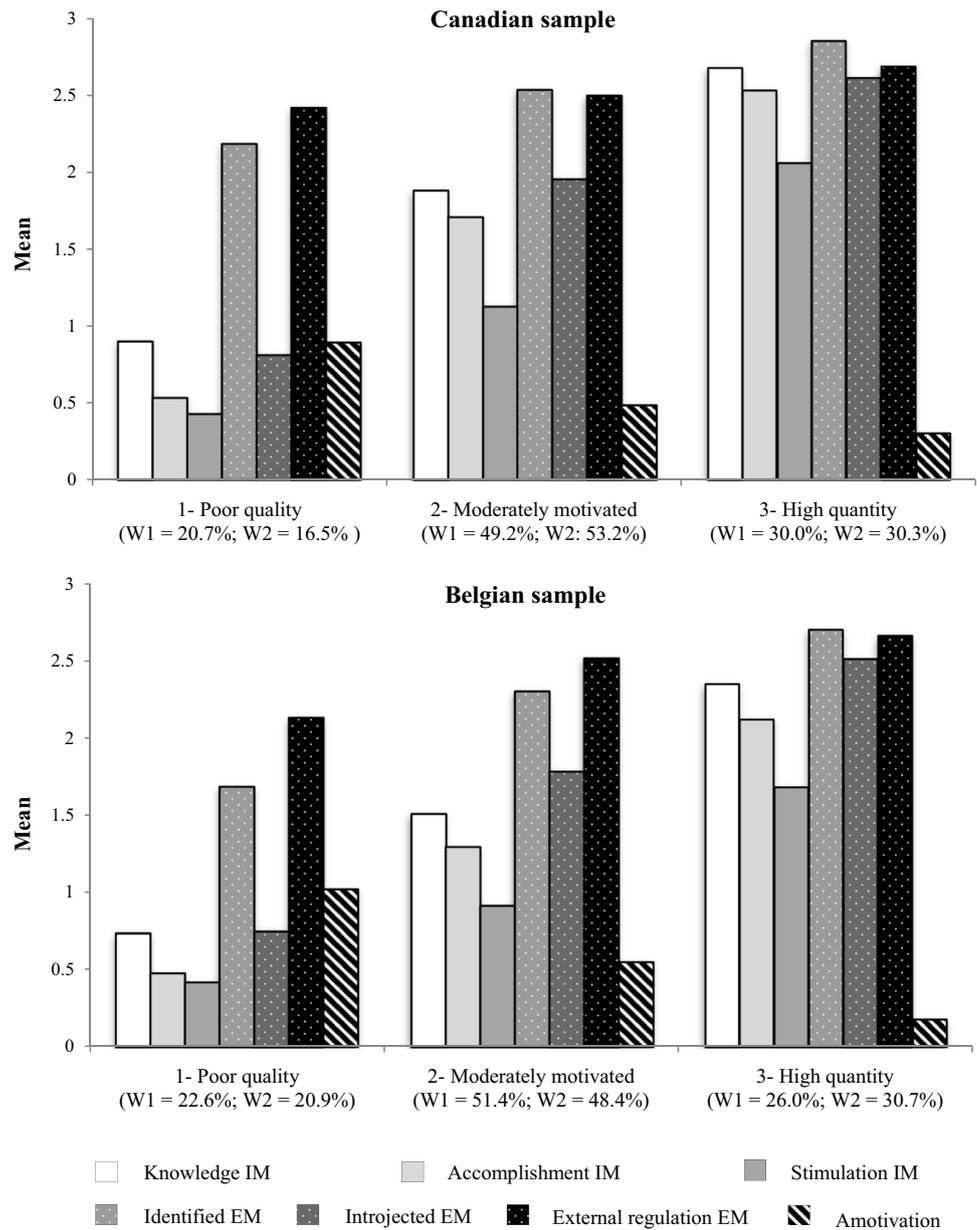


Table 4 Latent transition probabilities between academic motivation profiles from Wave 1 to Wave 2

Canadian sample					Belgian sample				
Latent transition probabilities matrix									
		Wave 2					Wave 2		
		Poor (16.5%)	Moderate (53.2%)	High (30.3%)			Poor (20.9%)	Moderate (48.4%)	High (30.7%)
		%	%	%			%	%	%
Wave 1	Poor (20.7%)	52.7	41.9	5.4	Wave 1	Poor (22.6%)	68.3	27.0	4.7
	Moderate (49.2%)	8.1	73.5	18.4		Moderate (51.4%)	10.6	72.3	17.1
	High (30.0%)	5.5	27.6	66.9		High (26.0%)	0.0	19.7	80.3

Poor = "poor quality" profile. Moderate = "moderately motivated" profile. High = "high quantity" profile

“poor quality” to “high quantity”, and vice versa) were relatively rare in both samples, with probabilities varying from 0.0% to 5.5%.

Mover-stayer LTA

Table 5 indicates the probabilities of staying in the same profile, or transitioning upward or downward across two consecutive years. Moverxf-stayer probabilities showed that most Canadian and Belgian adolescents remained in the same profile over a one-year period. We found that “stayer” were most likely to remain in the “moderately motivated” profile, followed by “stayer” who remained in the “high quantity” profile, and a smaller proportion of participants stayed in the “poor quality” profile.

Among those who switched profile membership over time, a greater proportion of Canadian and Belgian adolescents progressed to a more highly motivated profile than regressed to a less motivated profile. In both samples, about 16.0–19.0% of adolescents were classified as “mover up” while about 10.6–14.3% were classified as “mover down”. Transitions between the “moderately motivated” and the “high quantity” profiles were the most frequent. About 9.1–10.5% of the sample were students who shifted from the “moderately motivated” to the “high quantity” profile compared to about 5.9–7.5% for those who transitioned from the “poor quality” to “moderately motivated” profile, and about 1.0% for those who transitioned from the “poor quality” to the “high quantity” profile. Similarly, about 5.9–8.6% of the sample were students who shifted from the “high quantity” to the “moderately motivated” profile compared to about 4.4–4.7% for those who went from the “moderately motivated” to the “poor quality” profile, and about 0.0–1.3% for those that transitioned from the “high quantity” to the “poor quality” profile.

Predictors associated with mover-stayer transitions

Next, we examined whether parenting practices predicted the mover-stayer transition membership. First, we used the “stayer” as the reference group, followed by the “mover down” to allow for all possible comparisons between the three mover-stayer groups. Regression coefficients, adjusted for gender, age and family structure, are reported in Table 6 for each sample. As mentioned earlier, we measured need-supportive parenting practices in the Belgian sample only, and parental warmth / rejection and monitoring in the Canadian sample only.

Results indicated that youth reporting an increase in need-supportive parenting practices were significantly more likely to belong to the “mover up” trajectory than the “stayer” or the “mover down” trajectory. This result was observed for each of the need-supportive parenting practices, that is, interpersonal involvement (adjusted β varying from 0.18 to 0.23), parental structure (adjusted β varying from 0.18 to 0.23), and autonomy support (adjusted β varying from 0.11 to 0.15). Parental warmth / rejection and monitoring was not associated with motivation profile shifts. Figure 3 illustrates the transitions between motivation profiles over time and how parental practices are associated with such shifts among Canadian and Belgian adolescents.

Discussion

Development of motivation in high school has been mostly studied using a unidimensional, variable-centered approach, which models the average level of a global score of motivation over time. In the current study, we used a latent, multidimensional, and dynamic approach, which allowed for the investigation of within-student temporal (in)stability of motivational patterns based on the synergy of seven types of motivation postulated by SDT. As a first contribution, the use of LTA in this study

Table 5 Mover-stayer probabilities between academic motivation profiles from Wave 1 to Wave 2

Trajectories	Transitions	Probabilities (%)		Total sample (%)	
		Canada	Belgium	Canada	Belgium
Stayer	Poor stayer	11.7	15.9	66.8	73.4
	Moderate stayer	36.0	36.8		
	High stayer	19.1	20.6		
Mover up	From poor to moderate	7.5	5.9	19.0	16.1
	From poor to high	1.0	1.0		
	From moderate to high	10.5	9.1		
Mover down	From high to moderate	8.6	5.9	14.3	10.6
	From high to poor	1.3	0.0		
	From moderate to poor	4.4	4.7		

Poor = “poor quality” profile. Moderate = “moderately motivated” profile. High = “high quantity” profile

Table 6 Predictors associated with transitions between academic motivation profiles from Wave 1 to Wave 2 among the Canadian and Belgian samples

Potential predictors	Canadian sample			Belgian sample		
	Stayer vs		Mover down vs	Stayer vs		Mover down vs
	Mover down	Mover up	Mover up	Mover down	Mover up	Mover up
	β [95% CI]	β [95% CI]				
Change in parenting practices between Wave 1 and Wave 2						
Need-supportive parenting practices						
Interpersonal involvement				-.04 [-.14, .06]	.18*** [.09, .27]	.23*** [.10, .35]
Parental structure				-.04 [-.09, .01]	.06* [.01, .11]	.10** [.03, .17]
Autonomy support				-.04 [-.13, .06]	.11** [.04, .17]	.15* [.04, .27]
Parental acceptance / rejection						
Warmth / affection	-.16 [-.32, .01]	-.02 [-.12, .09]	.13 [-.04, .30]			
Hostility / neglect / rejection	.04 [-.03, .11]	.02 [-.03, .08]	-.02 [-.09, .06]			
Parental monitoring	-.04 [-.11, .04]	.02 [-.05, .08]	.05 [-.04, .14]			

In both samples, each potential predictor was calculated by subtracting the score at Wave 1 from the score at Wave 2. Models in both samples were adjusted for gender, age, and family structure at Wave 1 (or Wave 2, for those who only completed Wave 2)

β =regression coefficients. 95% CI=95% confidence intervals. * $p < .05$. ** $p < .01$. *** $p < .001$

provides several important insights about motivation pathways among a Canadian and a Belgian sample. The use of mover-stayer analyses helps going a step further than previous LTA studies (Hayenga & Corpus, 2010; Xie et al., 2022) by reducing the 27 possible profile transitions into only three meaningful motivation profile paths: the “stayer” (students remaining in the same profile), the “mover up” (those moving toward a higher-quality profile), and the “mover down” (those moving toward a lower-quality profile). In this manner, this study was able to make a second and truly unique contribution: to test whether improvement (decline) of different parental practices is associated with a positive (negative) shift in students’ motivation profiles. This objective is of prime importance because it helps to identify effective short-term levers of action to buffer or reverse an adolescents’ motivational downward trends, to stimulate student engagement until graduation, and to prevent school dropout.

Longitudinal transitions across motivation profiles

Contrary to variable-centered studies highlighting a general decline of school motivation during adolescence (Gnambs & Hanfstingl, 2016; Nishimura & Sakurai, 2017), the current study provided a more optimistic picture of motivation pathways across the course of high school. The first encouraging result was the relatively high temporal stability of students’ profile membership over one year, especially for students who were in the “high quantity” or the “moderately motivated” profiles at baseline. This result indicated that students with the highest quality of school motivation in ninth or tenth grade were still in the most adaptive profile one

year later in the tenth or eleventh grade. Similarly, students with moderately high motivation in ninth or tenth grade were categorized in a profile with the same level and pattern of motivation in the tenth or eleventh grade. Encouragingly, the “poor quality” profile was the most volatile among the three profiles. Although more than half of students remained in the “poor quality” profile one year later, a substantial proportion of them shifted toward another profile, inevitably of higher quality.

Other longitudinal, person-centered studies also observed large proportions of students (49-96%) remaining in the same school motivation profile during a period varying from two months to two consecutive academic years; these observations were made at various developmental periods, including elementary school (Tuominen et al., 2020), middle school (Hayenga & Corpus, 2010), and university (Gillet et al., 2017). Surprisingly, one of the other rare studies using LTA among high school students found relatively low temporal stability of motivation profiles (23-46% for most profiles; Xie et al., 2022), but they found greater stability for adaptive profiles compared to maladaptive profiles, as we did in our study. One possible explanation for the lower stability of profile membership found by Xie et al. (2022) is that they identified twice as many motivation profiles as we did. With a greater number of profiles may come greater resemblance among profiles, which could have led to increased shifts between profiles that are highly similar.

Another encouraging result is that students who changed motivation profile during the study were more likely to engage in an upward rather than a downward

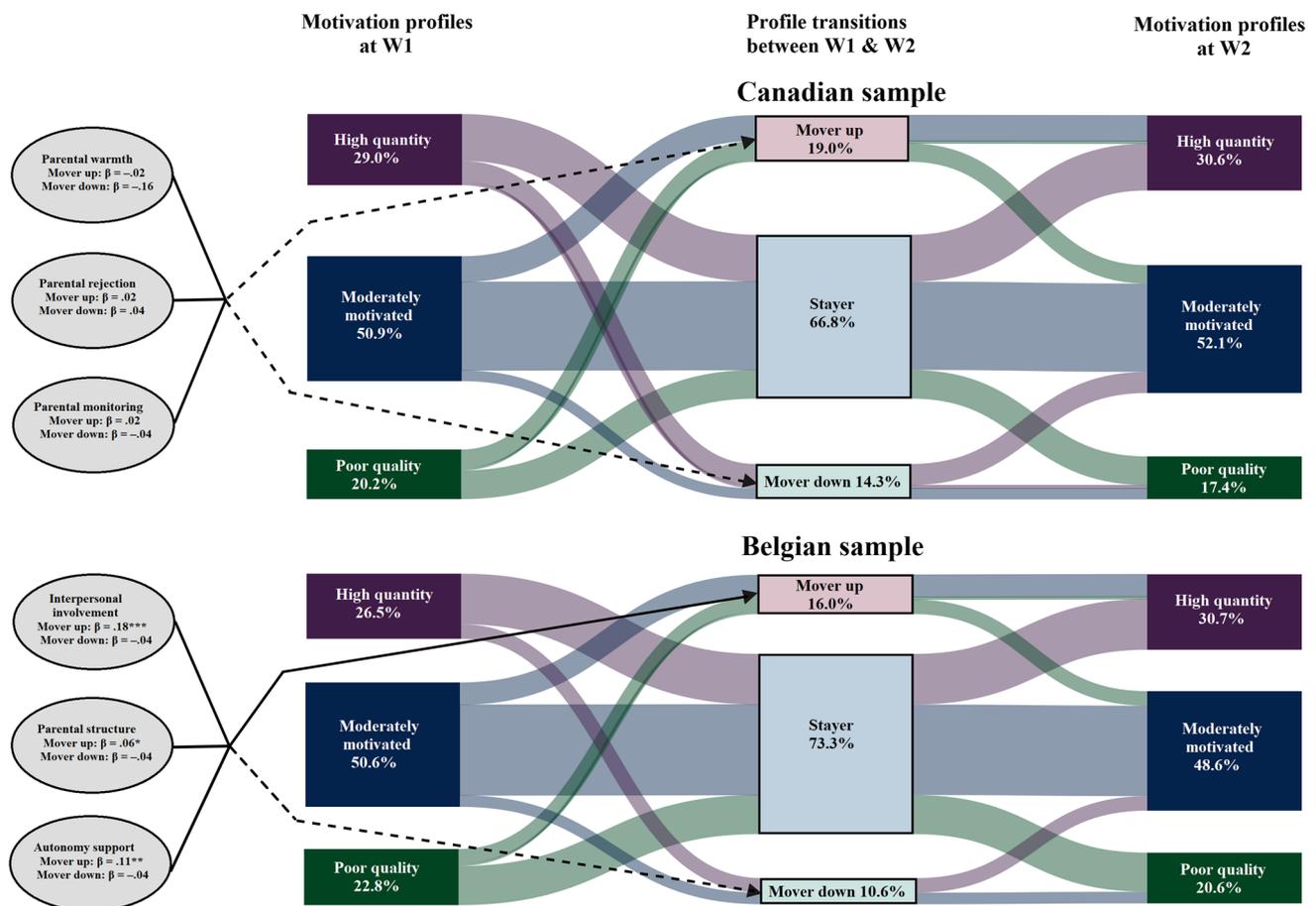


Fig. 3 Transition between motivation profile and their associated parental predictors in the Canadian and Belgian samples. Note. A coloured version of this figure is available online. Proportions of participants in each profile at Wave 1 and Wave 2 are slightly different from those reported in Table 4 because of the addition of the mover-

stayer variable in the LTA model. Dotted lines represent non-significant relationships between a predictor and the mover-stayer variable whereas the continuous line represents a significant relationship. β = regression coefficients. * $p < .05$. ** $p < .01$. *** $p < .001$

motivation path. This finding replicates results from a large study of a U.S. sample of high-schoolers (Xie et al., 2022); however, this was not the case among middle school students (Hayenga & Corpus, 2010). In the latter sample, motivation shifts occurred mostly toward lesser-quality profiles. Together, these findings are coherent with a variable-centered study that revealed a curvilinear trajectory of intrinsic motivation from 9 to 17 years old (Gillet et al., 2012). The authors found a decline in intrinsic motivation followed by a stabilization, and by an increase of motivation after 15 years old – the mean age of our participants at baseline – until 17 years old. To explain the increase of intrinsic motivation during high school, Gillet et al. (2012) suggested that greater autonomy granted during high school, notably by choosing optional courses in line with one’s interests, could positively affect motivation. Another potential explication for this pattern is that students at this level become more cognizant of their

future postsecondary orientation and of the academic requirements to be qualified for their desired program (e.g., cumulative grade point average, successful completion of specific courses). Students are possibly more motivated to devote time and energy to their schooling when their academic and professional goals become more concrete, stimulating, and closer in time. To put these hypotheses to the test, more research is required.

Another noteworthy finding consistent with previous studies (Hayenga & Corpus, 2010; Xie et al., 2022) is that students’ motivational transitions mostly occurred between adjacent profiles, especially between the “moderately motivated” and the “high quantity” profiles, rather than non-contiguous profiles. Therefore, transitioning from the most adaptive to the least adaptive profile was very unlikely—but the opposite was also true. Slow changes in general levels of motivation have been noted previously (Gillet et al., 2012; Gnambs & Hanfstingl, 2016), and our study adds

to the previous literature by highlighting how patterns of several types of motivation profiles evolves gradually over time. Considering that identified and external motivation levels are relatively similar across the “high quantity” and “moderately motivated” profiles, it seems that a transition from the former to the latter is mostly driven by a decrease in intrinsic and introjected motivation.

Although our study gave a brighter picture of how motivation develops during high school than previous studies, two groups of students need special attention: those who engaged in a downward motivation trend, and those who remained consistently in the poorest motivation profile. About 10.6–14.3% of our participants transitioned toward a less adaptive profile one year later. Although most of them regressed from the “high quantity” to the “moderately motivated” profile (and not the “poor quality” profile), parents and educators should continue to pay close attention to the “mover down” students in order to stop or reverse their declining motivation trajectory. In addition, a non-negligible proportion of students (17.4–20.6%) were in the poorest motivation profile at the end of the study, that is, in Grade 10 or Grade 11. Among them, the majority were already in the “poor quality” profile at the beginning of the study in Grade 9 or Grade 10. This suggests that early assessment of school motivation and preventive strategies are needed to reduce the risk of negative consequences associated with declining or low motivation (e.g., poor academic performance, disengagement from school, dropout; Gubbels et al., 2019).

Overall, the longitudinal transitions in motivation were replicated in two different cultural contexts (Canada and Belgium). Consequently, our findings appear to be robust. They demonstrated that, for a majority of high school students, their motivational strategy was stable during two consecutive years, even though they were attending different classes, with different teachers and some new classmates. One explanation for this finding might be that motivation patterns is largely crystalized for students when they reach high school years. It is noteworthy that students in the most adaptive profiles are most likely to maintain their high levels of motivation at least during one year, while students in the least adaptive profile present the most malleable motivational patterns, so the observed stability appears to work in favor of driving positive outcomes in youth. Alternatively, the apparent stability of profile membership may also reflect that a longer time span is required to observe motivational shifts at this stage of secondary school. This interpretation is consistent with prior findings showing that the intraindividual stability in motivation profile membership is lower with a longer time span (i.e., two consecutive school years; Xie et al., 2022) compared to a shorter interval (i.e., within one single academic year; Hayenga & Corpus, 2010). The fact that radical changes in motivation (i.e., from

“poor quality” to “high quantity”, or vice versa) were quite unlikely in our study may indicate that motivation, although it is a dynamic process, follows gradual rather than sudden shifts. The higher likelihood of a rising motivational trajectory as compared to a downward trajectory also paints an optimistic portrait, notably from an intervention perspective. Such findings illustrate the possibility of reversing a decline in motivation, or boosting low levels of motivation with support from the social environment.

Changes in parental practices and adolescents' shifts in motivation profiles

Positive or negative motivation shifts do occur during high school, although they are not the most prevalent trajectories. Yet, our results suggest that motivation patterns can be changed by increasing the quality of parenting practices.

Need-supportive parenting practices

Need-supportive parenting practices have been assessed only in the Belgian sample. As expected, our findings highlighted the critical role of a need-supportive family environment in promoting students' positive motivation shifts. More specifically, an increase in parental involvement, autonomy-support and structure, as perceived by the Belgian adolescents, each predicted a transition toward a higher-quality motivation profile. The satisfaction of basic psychological needs appears as particularly important during a period when adolescents strive to become more autonomous. These results are consistent with SDT. One of the central assumptions of this theory postulates that social environments which meet students' developmental needs are beneficial for the development and maintenance of higher quality motivation (Ryan & Deci, 2020). This is also in line with prior empirical evidence showing that parental autonomy support, structure, and involvement were linked to optimal motivation types and patterns (Farkas & Grolnick, 2010; Feng et al., 2019; Petit et al., 2022). Compared to other longitudinal studies, need-supportive parenting practices appeared to play an even more prominent role in improving student's motivation patterns. For instance, Gnambs and Hanfstingl (2016) found that basic needs satisfaction buffered the decline of youth's intrinsic motivation, but did not predict a rising motivational trajectory, contrary to our study.

Overall, the current results add to the literature by showing that when parents develop, enhance, or intensify their need-supportive practices toward their children, they contribute to increasing the level and the quality of their children's school motivation within a one-year timeframe. Therefore, parental autonomy support, structure and involvement appear to be promising targets of intervention to avoid or reverse a decline in motivation during high school by

creating a supportive environment in which children can feel autonomous, competent and emotionally supported. Given their significant associations with school motivation transitions, each of the three need-supportive parenting practices should be examined in future studies.

Parental warmth / rejection and monitoring

Parental warmth / rejection and monitoring have been measured only in the Canadian sample. Contrary to our expectations, a change in parental warmth/rejection and monitoring did not predict whether a student would remain stable or transition between motivation profiles among Canadian adolescents. A first potential explanation for this unexpected finding is the directness of the links between the parental and the academic dimensions. Contrary to need-supportive parenting practices for which the links with school motivation have been demonstrated via the satisfaction of basic psychological needs (Charlot Colomès et al., 2021; Zhou et al., 2019), mechanisms linking parental warmth/rejection or monitoring with school motivation are still not well understood. For instance, parental warmth has been more closely associated with well-being and social skills, and lack of parental monitoring has been more closely related to an increase in maladaptive behaviors than with academic and motivation outcomes (Butterfield et al., 2021; Villarreal & Nelson, 2018). It could be argued that the longitudinal relationships linking parental warmth or monitoring with school motivation are not as direct and may need more time to operate than those linking need-related parenting practices with student's motivation. Studies covering longer periods of observation are thus needed.

Secondly, this non-significant finding may be explained by Canadian adolescents being potentially less responsive to parental influences than Belgian adolescents are. Replication of the longitudinal associations (and lack thereof) between parental predictors and student's motivation shift in a diversity of samples from different countries is warranted.

Although an increase in parental warmth and monitoring was not associated with a shift in motivation pattern, fostering such parenting practices are still valuable from an interventional standpoint. In fact, our previous work (Petit et al., 2022) showed that parental warmth and monitoring were correlated with the most adaptive motivation profile. Improving parental warmth and monitoring abilities appears useful as a primary prevention strategy to prevent students from developing poor motivation at an early stage in their educational trajectory. However, in order to encourage positive changes in motivation later in adolescence, our data suggest that the development of need-supportive

parenting practices is a more effective target of intervention than parental warmth and monitoring. Thus, fostering need-supportive parenting skills should be included as part of secondary and tertiary prevention strategies to mitigate motivation decline.

Strengths, limitations and future directions

Although some limitations can be found in this study, they also offer opportunities for the development of new research initiatives. First, we improved the usual mover-stayer analysis, which consists in comparing all "stayer" to all "mover", by creating the "mover up" and "mover down" groups. This allowed us to get a more detailed portrait of changes in motivation profiles. However, all the participants who remained in the same profile were part of the "stayer", regardless of their initial levels and quality of motivation (i.e., "poor quality", "moderately motivated" or "high quantity"). Future studies should conduct even finer-grained comparisons not only according to the transition between profiles but also according to the initial level and quality of motivation (e.g., "poor quality stayer" vs. "poor quality mover up"). A larger number of participants than we had in this study would be required to test such models.

Second, although the current study examined how changes in the environment relate to shifts in motivation profiles, the non-experimental design did not allow for the determination of causality. Also, the hypothesized directionality of these associations cannot be confirmed because environmental and motivational changes were observed in parallel. Compared to the associations we hypothesized, reversed or reciprocal relations as well as additional unobserved variables are also plausible alternative explanations for our results. Thus, future studies should assess the possibility that the child affects parental behavior, using, for instance, transactional models. However, many of our results, including the association between an increase in psychological need satisfaction and upward motivation shifts, are grounded in solid theoretical and empirical foundations (Gnambs & Hanfstingl, 2016; Ryan & Deci, 2020; Soenens et al., 2017).

Third, although the one-year period of observation was among the longest compared to other longitudinal, person-centered studies in the same domain (Hayenga & Corpus, 2010; Ratelle et al., 2007; Vansteenkiste et al., 2009; Wormington et al., 2012; Xie et al., 2022), a longer time frame would be beneficial for future investigations. Ideally, these should start in elementary school and continue until the end of high school. This would allow to monitor the long-term (in)stability of motivation profiles, notably in critical periods identified previously, such as the transition between elementary and middle school.

Theoretical and practical implications

Our findings have implications for both self-determination theory and practices. With respect to theory, our findings provide support for the existence of multiple motivation trajectories rather than a single trajectory from an average student, and overall, motivation profiles maintain a relatively high level of stability during high school. Although motivation patterns tend to be stable, they are not fixed. Rather, they are still malleable for some students, with higher likelihood of shifts toward higher-quality than to lower-quality profile. Thus, our study contributes to the understanding of individual differences in the development of school motivation. Our data also show how need-supportive parenting practices and motivation are closely intertwined, and how these concepts should be examined in tandem.

With regards to practice, the finding that motivation profiles are relatively constant during high school emphasizes the necessity of fostering and supporting motivation during the first years of schooling, and on a continuing basis beyond that. Based on previous studies, the transition between primary and middle school constitutes a turning point in the decline of intrinsic motivation (Gallup, 2017; Gillet et al., 2012; Tuominen et al., 2020). Thus, it appears as a critical window of opportunity to implement strategies to support students' in developing increasingly autonomous motivation. Nevertheless, our findings also imply that improving the family environment for teenagers may help them become more motivated. Consequently, positive changes in school motivation should be examined from a systemic rather than an individual perspective. This approach encompasses the different social agents in youth's environment, instead of focusing solely on the student. Getting parents involved, teaching them how to be autonomy supportive and to structure effectively their children's environment could be a successful strategy to promote the satisfaction of psychological needs for autonomy, competence and relatedness, and to increase efficiently the quality of student's motivation. Family-based intervention programs, such as the one developed by Moè et al. (2020), seem promising in achieving this objective. This intervention program aims at fostering parental need-supporting abilities and enhancing parents' need satisfaction as well as intrinsic motivation. The authors noted that when the parents have their basic psychological needs satisfied and are intrinsically motivated, they are better able to create a positive context of learning for their children. They are also more likely to adopt need-supportive practices than frustrated parents, and they rely on more resources when assisting their children in their school activities. Such findings were replicated elsewhere (Lerner et al., 2022). In sum, improving the well-being of parents by helping them having their basic psychological needs fulfilled could bolster students' motivation.

Conclusion

The present study made a unique contribution to our field of research as it helped to uncover the distinct trajectories of school motivation followed by adolescents rather than only focusing on the average trend. Instead of following the average declining motivation trend previously showed (Gnambs & Hanfstingl, 2016; Nishimura & Sakurai, 2017), most Canadian and Belgian adolescents exhibit similar levels and quality of motivation patterns across a one year period. Youth with high-quality motivation exhibited the most stable patterns of school motivation, and youth with poor-quality motivation had the most unstable patterns. Shifts in motivation patterns do occur for a non-negligible minority of students, mostly toward an adjacent profile of higher quality. Our study supports the notion of motivation as a dynamic concept but whose fluctuations are gradual. Another important contribution of this study is the identification of parenting practices that predict an increase in motivation rather than a specific level or pattern of motivation at a single time point. We showed that youth who perceive an increase in need-supportive parenting practices tended to experience a shift toward a more adaptive profile. This suggests that the family environment is crucial for encouraging and strengthening academic motivation in teenage years. Intervention programs that support school motivation should thus include parents by focusing on strengthening their parenting abilities to fulfill their child's basic psychological needs.

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Authors' contributions Marie-Pier Petit conceptualized and conducted the analyses and wrote the manuscript. Marie-Hélène Véronneau directed the conception, design and data collection of the Canadian study. Cécile Mathys directed the conception, design and data collection of the Belgian study. Marie-Hélène Véronneau and Cécile Mathys reviewed and edited the manuscript, and approved the submitted version.

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Data availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Code availability Not applicable.

Declarations

Ethics approval The Canadian study was approved by the Institutional Review Board of the *Université du Québec à Montréal* (# 259_2020),

and the Belgian study was approved by the ethics committee of the faculty of Psychology of the *Université de Liège* (no associated ID at the time of the data collection). The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

Consent to participate Informed consent was obtained from all individual participants included in the study. For the Canadian sample, a signed parental consent form was also required for youth's participation; in the Belgian sample, parents were informed of their child's participation through a letter, and were invited to return a form if they refused to let them participate.

Consent for publication Not applicable; the manuscript contains no information that can personally identify an individual participant.

Conflicts of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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