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Nature, Implications and Determinants of Academic Motivation Profiles among Primary and Secondary Students

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Nature, Implications and Determinants of Academic Motivation Profiles among Upper Elementary and Secondary Students

Abstract

The present study sought to contribute to self-determination theory by examining the nature of adolescents' academic motivation profiles defined while considering its global and specific nature. The construct validity of these profiles was examined by considering their replicability across samples of upper elementary (n = 781) and secondary (n = 467) school students, as well as their associations with predictors (perceived parental need nurturing behaviors) and outcomes (academic achievement and expectations of success). Latent profile analyses revealed four profiles (*Non-Motivated*, *Identified*, *Amotivated*, and *Strongly Motivated*) characterized by differing levels of global and specific levels of academic motivation. These profiles were fully replicated across educational levels. Most profiles differed from one another in terms of outcomes, although differences in terms of outcomes associations were observed across educational levels. Finally, profile membership was predicted by global levels of need nurturing and by some of the specific need nurturing behaviors in a way that replicated across educational levels. Our results suggest that the specific qualities of academic motivation and the global levels of self-determination are equally important in the identification of academic motivation profiles.

Keywords: self-determination theory (SDT); academic motivation; parental need nurturing behaviors; academic achievement; academic expectations; latent profile analysis (LPA)

According to the Organization for Economic Co-Operation and Development (OECD, 2016), academic underachievement is one of the most critical challenges facing educational institutions worldwide. Academic achievement, typically operationalized in terms of grade point average, is used around the world as an indicator of students' educational success and represents a critical driver of students' admissions into further educational programs, educational attainment (Galla et al., 2019) and adult income (French et al., 2015). Outside of the educational area, lower academic achievement is also associated with higher levels of psychological difficulties (e.g., Huynh et al., 2019; Li & Lerner, 2011; Tóth-Király et al., 2021c). Likewise, students' expectation of success (i.e., their belief about the possibility of experiencing future success: Eccles, 2009), is also of great relevance to students' educational success given their strong associations with achievement-related choices and outcomes (Muenks et al., 2018; Wigfield & Eccles, 2002).

In educational psychology, academic motivation has long been positioned as a key driver of students' academic achievement and expectations of success. For instance, the organismic integration component of self-determination theory (SDT; Ryan & Deci, 2017) highlights that experiencing more autonomous (driven by pleasure and choice) as opposed to more controlled (driven by internal and external pressures) forms of motivation tends to be associated with better academic performance, educational persistence, and psychological wellbeing (Howard et al., 2021a). SDT conceptualizes academic motivation as a multidimensional construct, encompassing a range of motives (also referred to as behavioral regulations) that might co-exist for individual students (Howard et al., 2020). Indeed, different types of behavioral regulations have demonstrated unique associations with a variety of educational outcomes (e.g., Guay et al., 2016; Ryan & Deci, 2017; Ryan, 2023), suggesting that the adoption of a multidimensional understanding of academic motivation was likely to uncover a fine-grained understanding of the associations between academic motivation and educational outcomes. Arguably, the multidimensionality of academic motivation and the co-existence of distinct types of behavioral regulations in characterizing the motivational orientations of individual students is best captured by person-centered approaches (Morin et al., 2018). These approaches are naturally suited to the investigation of how distinctive configurations, or profiles, of behavioral regulation may differentially related to students' academic achievement.

The present study seeks to identify profiles (or subpopulations) of students characterized by distinct configurations of academic motivation. More specifically, the present study extends previous research in this area by (1) adopting a multidimensional representation of academic motivation; (2) accounting for the inherent dual global/specific nature of academic motivation; (3) establishing the replicability of the profiles by assessing their replicability across samples of upper elementary and secondary school students; (4) examining the associations between motivation profiles, academic achievement and expectations of success; and (5) considering the role of parental need nurturing behaviors as determinants of profile membership.

A unique contribution of this study comes from its reliance on a sample of students enrolled in the Serbian educational system, which differs from typical Western educational systems in several ways. First, elementary education (typically starting at ages 6-7) is compulsory in Serbia and is divided in two cycles: Lower elementary (grades 1-4) and upper elementary (grades 5-8). The latter of those cycles corresponds to middle school or junior high school in some other Western educational systems (i.e., grades 6-8). Second, in Serbia, secondary education (typically starting at ages 14-15) is delivered through a four-year general secondary school program (gymnasiums) leading to university, through a four-year vocational school program also leading to university, or through a three-year vocational school program leading to external employment. Beyond these specificities, secondary education roughly corresponds to high school in some other Western educational systems. Third, according to a recent OECD (2019) report, even though the Serbian educational system is performing well compared to other Balkan countries (Maghnoui et al., 2020), it still lags behind the OECD average. More precisely, Serbian elementary students occupied the 45th position (out of 79 participating OECD countries) in September 2018 (OECD, 2019). This report also revealed a slight but constant decrease in learning outcomes since 2012, particularly in reading and science. Moreover, Serbian elementary students remain more than a year behind the OECD average across all academic disciplines (e.g., science). Unfortunately, similar information is not currently available for Serbian secondary school students given the lack of nationwide examinations (OECD, 2018). Lastly, although Serbia has recently begun implementing educational reforms (e.g., introducing achievement standards at the end of compulsory education), the results of the present research may bring new insights to Serbian ongoing educational policies given that SDT has been proposed as an evidence-based theoretical framework for 21st century educational policies and practice (Ryan & Deci, 2020).

Self-Determination Theory and Profiles of Academic Motivation

The organismic integration component of SDT (Ryan & Deci, 2017) proposes that students engage in academic activities for a variety of reasons (i.e., behavioral regulations) which can be positioned along a continuum of self-determination ranging from the most self-determined to the least self-determined types of behavioral regulations (Howard et al., 2017, 2020). SDT generally differentiates between at least five forms of behavioral regulations: Intrinsic, identified, introjected, external, and amotivation. Students are driven by intrinsic motivation when they engage in their studies for the inherent enjoyment and satisfaction associated with it. Students motivated by identified regulation engage in their studies because they see them as personally valued and important. Intrinsic motivation and identified regulation are considered to represent autonomous forms of motivation, reflecting an engagement in one's studies driven by volitional reasons. Students driven by introjected regulation engage in their studies as a result of internal pressures (e.g., to increase self-worth or to avoid anxiety). In contrast, for students motivated by external regulations, these pressures are external (e.g., rewards or punishments). Introjected and external regulations are considered to represent controlled forms of motivation, reflecting an engagement in one's studies driven by non-volitional reasons in the form of internal of external pressures. Finally, amotivated students generally do not know why they should engage in their studies, they typically lack the volition or intention to do so. These five types of behavioral regulations are assumed to be organized along a global continuum of self-determination, ranging from intrinsic motivation (at one extreme) to amotivation (at the other extreme), with identified, introjected, and external regulations falling in between (Ryan & Deci, 2017). According to SDT, this continuum reflects students' global sense of self-directedness and volition towards their academic activities (i.e., the degree to which their motivation to engage in their studies is primarily driven by internal reasons), while the specificity uniquely associated with each specific form of behaviors regulation represents the reason underpinning this motivation (Howard et al., 2020).[1]

Previous studies have clearly documented the distinctive predictive validity of these various forms of motivation. More specifically, research has shown that autonomous motivations tend to be associated with more adaptive outcomes, whereas controlled motivations and amotivation tend to be associated with more maladaptive outcomes (Howard et al., 2021b; Ryan & Deci, 2017). However, SDT notes that these types of motivations are not mutually exclusive and can co-exist within individuals (Howard et al., 2020; Ryan & Deci, 2017). The most commonly occurring combinations of behavioral regulations are best captured by person-centered approaches which are naturally suited to the identification of academic motivation profiles defined by considering all forms of motivation.

So far, various studies have been conducted to assess elementary and secondary school students' academic motivation profiles. However, some of these studies (Corpus & Wormington, 2014; Hayenga & Corpus, 2010; Oga-Baldwin & Fryer, 2017; Vansteenkiste et al., 2009; Wormington et al., 2012) have only considered the broad categories of autonomous/controlled motivation, while others (Liu et al., 2009; Lv et al., 2019; Oga-Baldwin & Fryer, 2018, 2020a, 2020b; Paixao & Gamboa, 2017; Ratelle et al., 2007) have relied on a more comprehensive coverage of behavioral regulations. Despite these variations in operationalization, the results tend to converge on four common academic motivation profiles: (a) *Autonomous*: high autonomous and low controlled; (b) *Strongly Motivated*: high autonomous and high controlled; (c) *Controlled*: low autonomous and high controlled; and (d) *Non-Motivated*: low autonomous and low controlled. Beyond these common configurations, some additional profiles have also been identified in a subset of studies: A moderate autonomous high controlled profile

[1] It is critical to clarify that the interpretation of these specificities (i.e., specific factors) differs from the typical interpretation of each type of behavioral regulation in and of itself (not separated from the global continuum of self-determination factor). Indeed, whereas the latter reflects the total covariance among all items forming a subscale, the former (i.e., the specific factors) reflect the residual covariance between these items once the covariance between all items included in the measure has been absorbed by the G-factor. Thus, rather than reflecting the desire to pursue an activity for the pleasure that it procures (intrinsic) or because it matches one's personal values (identified), these S-factors might reflect the pleasurable nature of engaging in this activity (specific intrinsic) or the impression of a match between one's values and those conveyed by the activity (specific identified), but without also capturing the drive component (i.e., the desire to get involved).

(Lv et al., 2019), and a profile presenting moderate levels on all regulations (Ratelle et al., 2007; Oga-Baldwin & Fryer, 2020b). The presence of these additional profiles supports the need to rely on a finer-grained representation of academic motivation.

However, a common limitation of these previous studies lies in their failure to consider the dual global/specific structure of academic motivation as reflected in the SDT' self-determination continuum. Relying on an incomplete (excluding any number of motivations or collapsing them into more global constructs) or suboptimal (ignoring the global/specific nature) representation of academic motivation makes it impossible to directly assess the added value of each specific type of behavioral regulation over and above students' global levels of self-determination (i.e., a global indicator of their position on the self-determination continuum), which can only be achieved using a proper multidimensional methodology. Indeed, statistical research has demonstrated that when psychological constructs are known to present a coexisting global (i.e., global levels of self-determination) and specific (i.e., the unique quality associated with each type of behavioral regulation beyond global levels of self-determination) nature, failing to consider this form of multidimensionality is likely to lead to a lack of precision and theoretical clarity in latent profile estimation (Morin et al., 2016b, 2017; Morin & Marsh, 2015). Although studies accounting for this dual global/specific nature of motivation have recently been conducted to examine work motivation profiles among samples of working adults (Gillet et al., 2020b; Fernet et al., 2020; Howard et al., 2021b; Tóth-Király et al., 2021b), no study has so far adopted this approach to investigate profiles of academic motivation among student samples. Thus, although these studies have supported the idea that these improved methodologies made it possible to identify profiles differing from one another at both the global and specific levels, thus providing a richer perspective than previous research failing to disaggregate these two components, their results cannot be directly transposed to the reality of academic motivation and younger students. The present study was designed to address this limitation.

Upper Elementary and Secondary Academic Motivation Profiles

The present study sought to examine potential similarities and differences in the nature of the academic motivation profiles identified among samples of upper elementary and secondary school students. Indeed, these two educational levels correspond to the early and middle adolescent period of development, a period known to be characterized by a variety of life changing biopsychosocial transformations, encompassing the elementary to secondary school transition. These transformations are likely to have a major impact on the way students come to see themselves generally, and in relation to their education more specifically (Gottfried et al., 2001). To take a simple example, as a result of students' increasing cognitive abilities, activities that were initially purely driven by pleasure (i.e., intrinsic motivation) might come to be perceived as important as well (i.e., identified regulation), just like external pressures to achieve (i.e., extrinsic regulation) may progressively come to be self-imposed (i.e., introjected regulation) (e.g., Ryan & Deci, 2017). These transformations may modify the way students' approach their education in a way that could possibly lead to the emergence of distinct academic motivation profiles.

Generally, research has revealed changes in students' levels of academic motivation between these two developmental periods (e.g., Grouzet et al., 2006; Scherrer & Preckel, 2019). For instance, Gillet et al. (2012) reported a decrease in intrinsic motivation between the ages of 9 and 15, followed by a slight increase until the age of 17. Likewise, Otis et al. (2005) reported decreases in all types of extrinsic regulations between the ages of 13 and 15. These changes might be exacerbated in Serbia by the fact that students need to complete a national test to confirm their completion of compulsory education and allows them to gain admission into secondary education. Empirical evidence has already shown that this high-stakes national test tends to place pressure (thus potentially favoring more external types of regulations) on students (OECD, 2018). After gaining entry in secondary schooling, students are then exposed to a drastically changed educational environment, characterized by a greater need for autonomy, less support, and more competition among classmates, all of which can also change the way they approach their studies.

However, despite accumulating evidence supporting the idea that motivation levels are likely to change over time as students undergo the transition from upper elementary to secondary schooling, it remains that motivational profiles refer to more than just motivation levels, but capture students' holistic configuration of motives for engaging in their education. It is thus not surprising to note that motivation profiles tend to be far more stable over time than motivation levels (e.g., Fernet et al., 2020; Gillet et al., 2017; Howard et al., 2021b). In fact, their stability is even a key prerequisite to the ability to devise interventions likely to generalize to different educational levels. However, thus far, no study has ever considered whether and how motivation profile would remain stable across these two critically important educational and developmental periods. Based on these considerations, it appeared particularly important to test the extent to which the nature of the identified academic motivation profiles, as well as their associations with predictors and outcomes, would be replicated across students enrolled in these two educational levels. Given the many educational and developmental differences between these two samples, this comparison represents quite a robust test of replicability (or profile similarity, e.g., Morin et al., 2016c).

Academic Motivation Profiles, Academic Achievement and Expectations of Success

Previous variable-centered studies (e.g., Guay & Bureau, 2018; Guay et al., 2010; Howard et al., 2021a; Litalien et al., 2017) have reported moderate positive relations between academic achievement and the more autonomous forms of motivations (i.e., global self-determination, intrinsic motivation, and identified regulation), weak or null relations between achievement and the more controlled form of motivations (i.e., introjected and external regulation), and negative relations between achievement and amotivation. Likewise, prior person-centered research on academic motivation profiles has already documented associations between students' motivational profiles and a variety of educational outcomes (e.g., Gillet et al., 2017; Ratelle et al., 2007; Vansteenkiste et al., 2009). For instance, students corresponding to *Autonomous* or *Strongly Motivated* profiles tend to demonstrate higher levels of achievement than students corresponding to *Controlled* or *Non-Motivated* motivational configurations (Gillet et al., 2017; Lv et al., 2019; Oga-Baldwin & Fryer, 2020a; Ratelle et al., 2007; Vansteenkiste et al., 2009). Other studies, however, have also reported higher levels of achievement in for students corresponding to the *Autonomous* relative to *Strongly Motivated* profile while relying on an incomplete (intrinsic/extrinsic) operationalization of academic motivation (Corpus & Wormington, 2014), suggesting that further investigations are needed to clarify these differences while relying on a more accurate representation of the global/specific multidimensional nature of academic motivation.

According to expectancy-value theory (Eccles, 2009; Rosenzweig et al., 2019; Wigfield & Eccles, 2002), academic achievement-related processes should be mainly influenced by proximal constructs such as students' expectations of success. While research involving academic motivations as defined in SDT has rarely jointly considered students' expectations of success, some studies have investigated the associations between academic motivation and the academic self-concept, which is often used as a proxy for students' expectancies of success (e.g., Musu-Gillette et al., 2015; Schunk & Pajares, 2005; Trautwein et al., 2012). These studies have generally reported positive associations between students' intrinsic motivation and their reading self-concept (Guay et al., 2019) as well as between intrinsic value (i.e., a construct similar to intrinsic motivation) and students' math self-concept (Guo et al., 2015a, 2015b, 2016). Finally, using a more comprehensive representation of academic motivation, additional studies reported positive associations between the academic self-concept and students' levels of intrinsic and identified regulation, small positive or non-significant associations between the academic self-concept and students' levels of introjected regulation, small negative or non-significant associations between the academic self-concept and students' levels of external regulation, and negative associations between the academic self-concept and students' levels of amotivation (Areepattamannil & Freeman, 2008; Chanal & Guay, 2015). These results might be explained, in part, by a diathesis-stress model (Guay et al., 2001) proposing that students' perceptions of autonomy-support in their environment facilitates the development of more autonomous (as opposed to controlled) forms of motivation which, in turn, lead to better self-conceptions and expectations of success. This model thus suggests that more autonomously motivated students might allocate more time and energy to their studies, leading to more positive self-beliefs, perceived competence and expectations of success.

Perceived Parental Need Nurturing Behaviors and Students' Academic Motivation Profiles

Very little information is currently available to inform interventions about the potential predictors of academic motivation profiles. However, the basic psychological needs component of SDT, the main theoretical framework of this paper, postulates that students' academic motivation should be greatly influenced by the satisfaction of their basic psychological needs for autonomy, competence, and relatedness (Liu et al., 2009) which themselves are seen as being driven by the need nurturing conditions present in their social environment (Vansteenkiste et al., 2009). Indeed, the developmental model of SDT (Ryan & Deci, 2017; Yu et al., 2018) argues that the social environments in which students evolve (both at school and out of school) should play a key role in determining the nature of their unique motivation profile. Given the critical role played by parents in nurturing and supporting students' basic psychological needs and their academic motivation (e.g., Grolnick & Lerner, 2023; Ryan & Deci, 2017), the present study more specifically focuses on students' perceptions of their parents' need nurturing behaviors as a possible predictor of their academic motivation profiles. Importantly, given that the role played by parents in shaping development is known to be strong during the elementary school years, and to slowly fade way as children grown older (Cheng & Mallinckrodt, 2009; Helsen et al., 2000), it seemed particularly relevant to consider whether and how these effects would generalize to the two developmental periods considered in the present study (i.e., elementary *vs* secondary).

Within SDT (Ryan & Deci, 2017), perceived need nurturing behaviors are operationalized as six interrelated need supportive and thwarting dimensions, each of them corresponding one of the three needs (Rocchi et al., 2017a, 2017b). Autonomy support refers to the provision of choice and to the acknowledgement of students' perspectives. In contrast, autonomy thwarting refers to controlling language (i.e., rigid one-way interaction, forcing a child to think and act in a certain way, using a "must" and suppressing children's critical thinking) and conditional regard (i.e., when affection towards children is dependent on whether they exhibit certain expected behaviors). Competence support refers to encouragements and positive feedback, while competence thwarting involves the evocation of feelings of incompetence and the placing of emphasis on mistakes. Finally, relatedness support reflects the provision of care and support, while relatedness thwarting describes distance and rejection. Similar to motivation, need nurturing interpersonal behaviors are multidimensional. Thus, although distinct from one another, these behaviors also combine with one another to reflect one overarching dimension reflecting parental need nurturing behaviors (Tóth-Király et al., 2022).

The criterion-related validity of this representation of perceived need nurturing behaviors has been established in relation to wellbeing as well as need satisfaction and frustration (Bhavsar et al., 2020; Rocchi et al., 2017a, 2017b; Tóth-Király et al., 2022). SDT (Ryan & Deci, 2017) suggests that when students' feel that their basic psychological needs are supported (instead of thwarted) by their social environment, they are more likely to function in an optimal way, resulting in higher levels of self-determined or autonomous types of motivation. So far, research has supported this proposition in relation to perceived parental behaviors. More precisely, previous variable-centered research has reported positive associations between perceived autonomy supportive parental behaviors and more autonomous forms of motivation (e.g., Gillet et al., 2013; Lowe & Dotterer, 2013; Rocchi et al., 2017b), and non-significant or negative associations between these types of perceived behaviors and controlled forms of motivation (e.g., Dietrich & Salmela-Aro, 2013; Rocchi et al., 2017b). None of these studies, however, considered perceptions of relatedness or competence supportive or thwarting parental behaviors, or was explicitly designed to cover a comprehensive range of perceived need nurturing behaviors while also achieving a proper disaggregation of their global/specific aspects. As for person-centered research, we were able to identify a single study reporting positive associations between parental warmth perceptions and more intrinsically driven profiles among a sample of university students (Litalien et al., 2019). This scarcity of research highlights the need for additional investigations.

The Present Research

This study was designed to identify distinct profiles of academic motivations among upper elementary and secondary school students, while relying on multidimensional global/specific representation of their academic motivation. Based on previous studies, we expect students' academic motivation to be best represented by four to six profiles. We expect most of these profiles to match the most commonly occurring profiles (i.e., *Autonomous*, *Strongly Motivated*, *Controlled*, *Non-Motivated*) reported in previous studies. However, given our distinct methodological approach focusing on global and the specific facets of academic motivation, we expect additional profiles driven by specific types of motivations, but leave as a research question the number and nature of these additional profiles.

We also expected the most desirable profiles (i.e., characterized by moderate-to-high global levels of self-determined motivation and/or of specific forms of autonomous motivation) to be associated with higher levels of achievement and expectations compared to the less desirable profiles (i.e., characterized by low global levels of self-determined motivation and/or of specific forms of controlled motivation or amotivation). In addition, we expected global levels of perceived need nurturing behaviors and specific levels of perceived need supportive behaviors to predict membership into more desirable profiles, but specific levels of perceived need thwarting behaviors to predict membership into less desirable profiles.

Finally, as a test of replicability of our results, we also considered the extent to which the number and nature of those profiles, as well as their associations with predictors and outcomes will be replicated across samples of upper elementary and secondary students.

Method

Procedure and Participants

This study relies on data collected in schools located in Vojvodina, the northern province of Serbia, and the most developed region in the country. Schools were recruited using a stratified random sampling. In the first stage, schools were selected from the official list (provided by the Provincial Secretariat for Education, Regulations, Administration and National Minorities – National Communities) of all elementary (*N* = 347) and secondary (*N* = 119) schools operating in this region of the country. After randomly selecting a subset of schools (*n* = 7 elementary and *n* = 5 secondary), we also proceeded to a random selection of classes in each of these schools, while limiting our selection to upper elementary grades in primary schools and to the second and third year in secondary schools. Participation was voluntary and participants were free to withdraw at any time without consequence. Researchers administered paper-pencil questionnaires to students, during their regular classroom period, and were present during testing to provide additional information or explanations when necessary. For minor participants, active parental consent was obtained (i.e., physical signatures were obtained from all parents). All participants also actively consented to participate, and the data was anonymized prior to analyses.

A total of 1248 Serbian students recruited from seven upper elementary (seventh and eighth grades, *n* = 781; 53.1% female, aged between 13 and 16, *M* = 13.75, *SD* = .63) and five secondary (second and third years, *n* = 467; 60.8% female, aged between 16 and 19, *M* = 17.03, *SD* = .73) schools participated in this study. All schools were urban schools located in city areas. All secondary schools were large, with seven to nine classes per grade. Most students (upper elementary: 88.5%, secondary: 78.6%) lived with both of their parents, most of whom were employed full-time (upper elementary: 87.3% fathers and 76.3% mothers; secondary: 77.3% fathers and 65.4% mothers). On the average, students rated the income of their parents as below average (upper elementary: 17.6% mothers and 7.6% fathers; secondary: 28.5% mothers and 14.4% fathers), average (upper elementary: 70.6% mothers and 72.1% fathers; secondary: 63.9% mothers and 70.8% fathers) or above average (upper elementary: 11.7% mothers and 20.3% fathers; secondary: 7.5% mothers and 14.8% fathers).

Measures

Academic motivation. The Serbian version (Šarčević, 2015) of the Academic Motivation Scale (AMS; Vallerand et al., 1989) was used to measure students' academic motivation. The AMS was previously translated from its original French version to Serbian using a standardized translation back-translation procedure (Beaton et al., 2000) and validated in Serbia (Šarčević, 2015). The stem "I go to school…" was followed by five subscales (four items each): Intrinsic (*α* = .742; e.g., "Because my studies allow me to continue to learn about many things that interest me"), identified (*α* = .764; e.g., "Because I think that a high-school education will help me better prepare for the career I have chosen"), introjected (*α* = .745; e.g., "To show myself that I am an intelligent person"), external (*α* = .712; e.g., "In order to have a better salary later on") and amotivation (*α* = .787; e.g., "I don't know; I can't understand what I am doing in school"). Items were rated on a five-point scale (1 = *strongly disagree*, 5 = *completely agree*).

Academic achievement and Expectations of success (Outcomes). Academic achievement was measured with a single item (i.e., *Please provide your school achievement from the first semester of the school year*; upper elementary: *M* = 4.32, *SD* = 0.78; secondary *M* = 2.84, *SD* = 1.40; Cohen's *d* = 1.31). It is a common practice in many Eastern European and Balkan countries to rely on the same grading system in elementary and secondary education, where GPA is calculated as an average across all subjects. Responses were provided using the following answer scale: 1 = unsatisfactory (mean grade across all subjects is lower than 1.50, insufficient for passing), 2 = sufficient (mean grade is between 1.50 to 2.49), 3 = good (mean grade is between 2.50 to 3.49), 4 = very good (mean grade is between 3.50 and 4.49) and 5 = excellent (mean grade is at least 4.5). Serbian students are highly familiar with this type of rating, which is used throughout their education to assess achievement. Students' expectations of success were also measured with a single item (i.e., *What level of success do you expect in your further education*; upper elementary: *M* = 4.56, *SD* = 0.65; secondary: *M* = 4.37, *SD* = 0.78), rated using the same five-point response scale (1 = *unsatisfactory*, 5 = *excellent*).

Our decision to rely on a self-reported measure of achievement was predicated on privacy and ethical considerations which prevent educational institutions from disclosing official school records in Serbia. However, research has generally revealed high correlations between self-reported grades and actual school grades, and shown that both types of achievement indicators tend to predict outcomes in a similar manner (Kuncel et al., 2005; Noftle & Robins, 2007). To minimize the potential biases associated with self-reported grades as much as possible, the following precautions were also taken. First, we used self-reported GPA obtained at the end of the first academic semester (Fall/Winter) which does not contribute to the final GPA obtained at the end of the second semester. For this reason, GPA obtained at the end of the first semester does not influence students' chances of enrolment in subsequent educational levels, which makes them objective and less likely to be characterized by high-ceiling effects (Šarčević & Vasić, 2014; Vasić, 2001). Second, since fear of evaluation tends to be one of the main reasons for overestimating GPAs, students were encouraged to be as honest as possible when completing the questionnaires and were ensured of the confidentiality of these responses (which was reinforced by the fact that they were not asked to provide any personal identification data).

Perceived parental need nurturing behaviors (Predictor). Students' perceptions of their mothers' and fathers' need nurturing behaviors were measured separately using the Serbian version (Šakan et al., 2018) of the Interpersonal Behaviors Questionnaire (IBQ; Rocchi et al., 2017a) which was developed through a standardized translation back-translation procedure (Beaton et al., 2000). The stem "My mother" and "My father" were followed by 24 items forming six four-item subscales: autonomy support (α_{father} = .772, α_{mother} = .752, α_{combined} = .856; e.g., "Support my decisions") and thwarting (α_{father} = .733, α_{mother} = .751, α_{combined} = .861; e.g., "Impose their opinions on me"), competence support (α_{father} = .624, α_{mother} = .641, α_{combined} = .792; e.g., "Encourage me to improve my skills") and thwarting (α_{father} = .721, α_{mother} = .725, α_{combined} = .844; e.g., "Point out that I will likely fail"), relatedness support (α_{father} = .766, α_{mother} = .698, α_{combined} = .828; e.g., "Take the time to get to know me") and thwarting (α_{father} = .630, α_{mother} = .633, α_{combined} = .797; e.g., "Are distant when we spend time together"). Items were rated on a 5-point scale (1 = *strongly disagree*, 5 = *completely agree*).

Analyses

Preliminary Analyses

All analyses were conducted using Mplus 8.5 (Muthén & Muthén, 2017). Prior to the main analyses, we estimated preliminary measurement models to derive factor scores (estimated in standardized units with $M = 0$ and $SD = 1$) for the main analyses. Following recent research (Howard et al., 2018, 2020; Litalien et al., 2017), academic motivation was modeled using a bifactor exploratory structural equation modeling (bifactor-ESEM; Morin et al., 2016a, 2020b) approach, allowing for the estimation of a global (G-) factor reflecting students' academic self-determination (defined by a pattern of factor loadings matching the theoretical position of all items on the self-determination continuum), and of non-redundant specific (S-) factors reflecting the unique quality of each motivation subscale left unexplained by the G-factor. Similarly, based on recent empirical evidence (Tóth-Király et al., 2022), maternal and paternal need nurturing behaviors were also modeled using a bifactor-ESEM approach in combination with a correlated trait-correlated method minus one approach (Eid et al., 2008; Morin et al., 2020b). To ascertain that we relied on comparable factors scores across the upper elementary and secondary samples, motivation factor scores were saved from a fully invariant measurement model (Millsap, 2011). In the case of the perceived need nurturing parental behaviors, we verified the absence of measurement biases across samples using a multiple indicators multiple causes (MIMIC) approach (Morin et al., 2013), which was made necessary by the complexity of the measurement model underlying these behaviors (which made it impossible to adopt a multigroup approach to tests of measurement invariance). These preliminary analyses supported the complete invariance of academic motivation ratings across education levels, the lack of differential item functioning of the parental behaviors as a function of education levels, and revealed satisfactory levels of composite reliability (McDonald, 1970)

Latent Profile Analyses (LPA) and Tests of Profile Similarity

Using factor scores from the preliminary measurement models, LPAs were estimated with the maximum-likelihood robust estimator (MLR). For upper elementary and secondary school students separately, solutions including one to eight profiles were estimated with freely estimated means. Although there are advantages to also allowing indicators' variances to vary across profiles (Peugh & Fan, 2013), these more complex models failed to converge on proper solutions suggesting that they might have been overparameterized and supporting our more parsimonious specification (Chen et al., 2001). Models were estimated using 5000 random start values, 1000 iterations, and 200 final optimizations (Hipp & Bauer, 2006).

When selecting the optimal number of profiles, we considered the meaning, the theoretical conformity, and the statistical adequacy of the solutions, as well as various statistical indicators (e.g., Morin et al., 2020a): The Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), the Consistent AIC (CAIC), the Sample-Size-Adjusted BIC (SSABIC), the adjusted Lo-Mendell-Rubin (aLMR) likelihood ratio test, and the Bootstrap Likelihood Ratio Test (BLRT).

Once the optimal solution was selected in each sample, multi-sample tests of profile similarity were conducted via multigroup LPA in the following sequence (Morin et al., 2016c): (1) configural similarity; (2) structural similarity; (3) dispersion similarity; and (4) distributional similarity. Similarity is achieved when at least two information criteria out of the CAIC, BIC, and SSABIC have the same or a lower value relative to the previous level of similarity.

Associations Between Profile Membership, Outcomes, and Predictors

The outcomes (academic achievement and expectations of success) were directly integrated into the most similar LPA solution to verify whether profile-specific outcome levels differed across samples. Two models were estimated: (1) the profile-specific outcome means were allowed to differ across profiles and educational level; (2) these outcome means were constrained to be equal across educational levels to test the explanatory similarity of this solution across samples (Morin et al., 2016c; Morin, & Litalien, 2019). Statistically significant mean differences between each pair of profiles were examined via Mplus' MODEL CONSTRAINT function, using the multivariate delta method (Raykov & Marcoulides, 2004).

Finally, the associations between the predictors (perceived parental need nurturing behaviors) and profile membership were assessed by the direct inclusion of the predictors in the most similar LPA model using a multinomial logistic regression function. Again, two alternative models were contrasted: (1) associations between profile membership and predictors were freely estimated across the two educational levels; (2) these associations were constrained to equality across educational levels to test their predictive similarity across samples (Morin et al., 2016c; Morin & Litalien, 2019).

Results

Results pertaining to the identification of the optimal time-specific LPAs are reported at the top of Table 1 and are discussed in Appendix 2 of the online supplements. Overall, a four-profile solution was identified as optimal at both time points. The results from the tests of profile similarity conducted on this four-profile solution are presented in the middle section of Table 1, and support the complete (i.e., configural, structural, dispersion, and distributional) similarity of this solution across educational levels as evidenced by the lower values on at least two information criteria out of the CAIC, BIC, and SSABIC. The final model of distributional similarity model was thus retained for interpretation. This solution is illustrated in Figure 1, and parameter estimates are reported in Table S13 of the online supplements.

Profile 1 characterized 17.92% of the students presenting lower than average levels on all global and specific behavioral regulations. This profile was thus labelled *Non-Motivated*. Profile 2 characterized 16.15% of the students presenting slightly higher than average global levels of self-determination and specific levels of intrinsic motivation, higher than average specific levels of identified regulation, slightly lower than average specific levels of external regulation, and lower than average specific levels of introjected regulation and amotivation. This profile was labeled *Identified*. Profile 3 characterized 31.46% of the students presenting slightly lower than average global levels of self-determination, average specific levels of intrinsic, identified, introjected and external regulation, and high specific levels of amotivation, leading us to label this profile *Amotivated*. Finally, Profile 4 was the largest (34.47%) and characterized students presenting higher than average global levels of self-determination and specific levels of introjected regulation, coupled with slightly higher than average specific levels of identified and external regulation, average specific levels of intrinsic motivation, and lower than average specific levels of amotivation. We thus labeled this profile *Strongly Motivated*.

Achievement-Related Outcomes of Profile Membership

Results from the analyses of associations between profile membership and the outcomes are reported in the lower section of Table 1. The model of explanatory similarity (in which profile-specific outcome levels were constrained to be equal across upper elementary and secondary students) resulted in higher values on all information criteria when compared to the model in which profile-specific outcome levels were allowed to differ across samples and was thus rejected by the data. This rejection suggests that the relations between the profiles and the outcomes are not entirely equivalent across educational levels. We thus pursued tests of partial explanatory similarity by examining the results from the model in which the profile-specific outcomes levels were allowed to differ across sample to see if differences could be limited to a subset of parameters. This examination led us to estimate a model of partial explanatory similarity in which three profile-specific outcome means were allowed to differ across samples, whereas the other profile-specific outcomes means were constrained to equality across samples. This solution of partial explanatory similarity was supported by the observation of lower values on the CAIC and BIC relative to the model in which these associations were completely allowed to differ across samples. Results from this model of partial explanatory similarity are reported in Table 2. These results show that, in the upper elementary sample, academic achievement levels were highest in the *Identified* profile, followed by the *Strongly Motivated* and *Amotivated* profiles (which were not distinguishable from one another), and finally by the *Non-Motivated* profile. In contrast, in the secondary sample, academic achievement levels were highest in the *Strongly Motivated* profile, followed equally by the *Identified* and *Amotivated* profiles, and finally by the *Non-Motivated* profile. In contrast, for both samples, expectations of success were highest in the *Strongly Motivated* and *Identified* profiles (which did not differ from one another), followed by the *Amotivated* profile, and then by the *Non-Motivated* profile.

Perceived Need Nurturing Parental Behaviors as Predictors of Profile Membership

Results from the predictive models are reported in the bottom section of Table 1 and support the superiority of predictive similarity model (as evidenced by the lower values on all information criteria), suggesting that the relations between the predictors and profiles can be considered to be equivalent across educational levels. The model of predictive similarity was thus retained for interpretation and the results from this model are reported in Table 3. These results first showed that higher perceived levels of global need nurturing behaviors predicted a higher likelihood of membership into the *Strongly Motivated* profile relative to all other profiles, and into the *Identified* profile relative to the *Non-Motivated* one. Second, students who felt exposed to higher specific levels of relatedness support were more likely to correspond to the *Amotivated* or *Strongly Motivated* profiles, relative to the *Non-Motivated* and *Identified* profiles. Third, perceived exposure to higher specific levels of autonomy thwarting predicted a higher likelihood of membership into the *Strongly Motivated* profile relative to all other profiles. Fourth, perceived exposure to higher specific levels of competence thwarting predicted a higher likelihood of membership into the *Strongly Motivated* profile relative to the *Non-Motivated* and *Identified* profiles, and into the *Amotivated* profile relative to all other profiles. Fifth, perceived exposure to higher specific levels of relatedness thwarting predicted a higher likelihood of membership into the *Amotivated* profile relative to the *Non-Motivated* and *Strongly Motivated* profiles. Finally, perceived exposure to higher levels of parental inconsistency predicted a higher likelihood of membership into the *Amotivated* profile relative to the *Strongly Motivated* one.

Discussion

Discussion of Key Findings

Self-determination theory (SDT; Ryan & Deci, 2017) proposes that students' academic behavior is underpinned by a series of behavioral regulations, organized along a continuum of self-determination (Howard et al., 2017, 2020). Anchored in the recognition that individual students' academic motivation is best capture by a combination of various behavioral regulations (Howard et al., 2020), the present study identified four commonly occurring configurations (or profiles) of academic motivation among samples of upper elementary and secondary school students. These profiles were estimated by relying on an operationalization of academic motivation allowing us to properly disaggregate students' global levels of self-determined academic motivation from their specific levels of behavioral regulation left unexplained by this global level (Howard et al., 2018, 2020; Litalien et al., 2017; Ryan & Deci, 2017). These profiles were fully replicated across samples of upper elementary and secondary school students, and most profiles differed from one another in terms of academic achievement and expectations of success. Finally, youth's global and specific perceptions of their parents need nurturing behaviors predicted profile membership in a way that replicated across upper elementary and secondary school levels.

Theoretical Implications

From a theoretical perspective, SDT (Ryan & Deci, 2017; Ryan, 2023) has always advocated that students are characterized by distinct behavioral regulations that can also be juxtaposed to form a global self-determination continuum. Variable-centered studies (Howard et al., 2018; Litalien et al., 2017) have shown that global levels of self-determination can co-exist with the unique qualities associated with each type of behavioral regulation. The present study adds to this body of research by demonstrating how this dual global/specific nature of academic motivation can be used to identify students' motivation profiles. This approach allowed us to avoid conflating the effects attributable to the global and specific levels, thus clearly showing that global levels of self-determination are key components of students' motivational profiles. In addition, this approach also helped us to uncover the unique added value associated with at least two specific types of behavioral regulation: Identified regulation and amotivation. A similar conclusion can be drawn regarding the added value of separating the global and specific effects parental need nurturing behaviors (Tóth-Király et al., 2022).

Students' Academic Motivation Profiles. Our results revealed that four profiles best representing the academic motivation configurations most commonly observed among samples of upper elementary and secondary school students, thus supporting our a priori expectations. Also matching our expectations, two of these profiles corresponded to those most frequently identified in previous studies as representing students that were either not motivated towards studying at all (i.e., *Non-Motivated*; Hayenga & Corpus, 2010; Liu et al., 2009; Lv et al., 2019; Oda-Baldwin & Fryer, 2020a; Ratelle et al., 2007; Vansteenkiste et al., 2009) or who were motivated by both internal and external reasons (i.e., *Strongly Motivated*; Corpus & Wormington, 2014; Hayenga & Corpus, 2010; Liu et al., 2009; Lv et al., 2019; Oga-Baldwin & Fryer, 2017, 2018, 2020a, 2020b; Ratelle et al., 2007; Vansteenkiste et al., 2009; Wormington et al., 2012).

We also identified two profiles in which students appeared to be mainly driven by specific forms of motivation. The first of those profiles (*Identified*) was mainly characterized by high specific levels of identified regulation and low specific levels of introjected regulation and amotivation. This profile thus shared some similarities with the autonomous profiles identified in many previous studies (Corpus & Wormington, 2014; Hayenga & Corpus, 2010; Liu et al., 2009; Lv et al., 2019; Oga-Baldwin & Fryer, 2017, 2018, 2020a, 2020b; Paixao & Gamboa, 2017; Ratelle et al., 2017; Vansteenkiste et al., 2009; Wormington et al., 2012). However, rather than being driven by all types of autonomous motivations, this profile was characterized by average global levels of self-determination and specific levels of intrinsic motivation. Students belonging to this profile are mainly driven towards their studies as a result of finding their education to be personally important and valuable for their own personal development and future career. These results also suggest that some of the autonomous profiles identified in previous studies might have also been primarily driven by identified regulation, although this dominance might only appear once these levels are properly disaggregated from students' global levels of self-determination. Pending replication, this profile might be somehow specific to the educational area as only one (Howard et al., 2021b) of the previous studies (Gillet et al., 2020b; Fernet et al., 2020; Tóth-Király et al., 2021b) of work motivation profiles relying on an approach similar to that used in the present study identified a similar profile.

The second of those profiles (*Amotivated*) seemed to be mainly characterized by amotivation (rather than simply by low levels of motivation), coupled by slightly lower than average global levels of self-determination. This profile shared similarities with a configuration previously identified among high school students by Ratelle et al. (2007) and Liu et al. (2009). Indeed, amotivation was one of the core defining features of one of the profile identified in these studies, although it was also accompanied by slightly elevated levels of external regulation in both cases. In the present study, although the *Amotivated* and the *Non-Motivated* profiles might appear quite similar in terms of phenomenology, an important distinction between them is related to the presence (or absence) of high levels of amotivation. On the one hand, *Non-Motivated* students seem neutral about going to school as a result of their lack of intrinsic or extrinsic motivation. One the other hand, *Amotivated* students seem to display a more negative (rather than neutral) motivational orientation characterized by high levels of amotivation, indicating an active orientation against academic activities (Legault et al., 2007). Thus, while *Non-Motivated* students might be passively against going to school, their *Amotivated* peers seem to be more actively against it. Naturally, these propositions should be investigated using in-depth qualitative responses from *Non-Motivated* and *Amotivated* students. Nevertheless, the rarity of studies in which a similarly *Amotivated* profile was identified is likely due to the fact that so few of the previous studies (Liu et al., 2009; Ratelle et al., 2007) incorporated a measure of amotivation. The present study thus reinforces the utility of considering amotivation in academic motivation profiles.

Unexpectedly, no profile dominated by controlled forms of motivation could be identified in this study, whereas such profiles have been frequently identified in the educational (Corpus & Wormington, 2014; Hayenga & Corpus, 2010; Liu et al., 2009; Lv et al., 2019; Oga-Baldwin et al., 2017, 2018, 2020a, 2020b, Ratelle et al., 2007; Vansteenkiste et al., 2009; Wormington et al., 2012) areas. On the one hand, this observation might be due to our more precise (i.e., global/specific, and incorporating amotivation) operationalization of academic motivation, which might have led to a more accurate picture of students' motivation, suggesting that purely controlled profiles might only rarely occur in this age group. In fact, only half of previous studies focusing on work motivation profiles identified a profile that appeared to be mainly driven by controlled forms of regulations (Gillet et al., 2020b; Howard et al., 2021b), whereas other studies failed to identify a similar profile (Fernet et al., 2020; Tóth-Király et al., 2021b). On the other hand, person-centered evidence is known to emerge from an accumulation of studies leading to the identification of a core set of profiles that seem to emerge across all conditions (i.e., *Non-Motivated* and *Strongly Motivated*), of a second set of profiles that seem to only emerge in specific conditions, and of a last set of profiles that are only idiosyncratic to specific studies (e.g., Meyer & Morin, 2016). As such, additional research will be needed to determine the categories that will best describe our *Identified* and *Amotivated* profiles, as well as a possible profile mainly driven by controlled forms of motivation.

Academic Motivation Profiles, Academic Achievement and Expectations of Success. Our results showed that the academic motivation profiles identified in this study presented a well-differentiated pattern of associations with students' levels of academic achievement and expectations of success, although not all profiles differed from each other on both outcomes and the associations involving academic achievement were found to differ across samples of upper elementary and secondary school students. First, and in line with our expectations and with SDT (Ryan & Deci, 2017), the *Non-Motivated* profile was associated with the least desirable outcome levels (low academic achievement and expectations of success).

Second, the *Identified* profile was found to be associated with the highest level of achievement in upper elementary level, followed by the *Strongly Motivated* and *Amotivated* profiles (which were not distinguishable from one another). Even though similar results have been previously reported in studies of university students (Gillet et al., 2017), our results suggest that, among upper elementary students, high global levels of self-determination might not be able to buffer and protect students against the negative effects associated with the high levels of controlled motivations observed in the *Strongly Motivated* profile. More importantly, the fact that achievement levels did not differ between upper elementary students corresponding to the *Strongly Motivated* and *Amotivated* profiles even suggest that high levels of controlled motivation might decrease (or even cancel) the benefits afforded by high global levels of self-determination observed in the *Strongly Motivated* profile. This result could possibly be related to the earlier developmental stage of upper elementary students. More precisely, elementary students' sense of volition might not yet be entirely formed as they are still exploring the relative interest and value of various academic activities and school subjects, and have not yet started to question their personal willingness to attend school, which is still seen as a normal and unavoidable part of their lives. In addition, by being more controlling and less supportive than the secondary school environment, the elementary school environment also leaves less room for students to develop their sense of volition. In contrast, the secondary school environment where students start to make their own choices regarding what they want to study, and how they want to study it. As such, the reduced sense of volition, or self-determination, of elementary students might explain why it might not have been sufficient to buffer the negative effects of controlled motivation in this age group. These explanations are supported by a recent longitudinal study (Guay et al., 2021) showing that global self-determination levels show a clear increasing trajectory among most students between the age of 13 and 15.

Third, the results obtained in relation to the academic achievement of secondary school studies are more aligned with our expectations and SDT (Ryan & Deci, 2017), revealing that these levels were highest among *Strongly Motivated* profile, followed by the *Identified* and *Amotivated* (which were not distinguishable from one another), and then by the *Non-Motivated* profile. These results are more consistent with those reported in previous studies highlighting the value of more self-determined forms of motivation (e.g., Gillet et al., 2017; Vansteenkiste et al., 2009), while also highlighting the importance of considering students' global levels of self-determination (Ryan & Deci, 2017). Indeed, profile-specific global levels of global self-determination appeared to directly follow the profile-specific levels of academic achievement, being highest in the *Strongly Motivated* profile, followed by the *Identified* and *Amotivated* profiles, and finally by the *Non-Motivated* profile. These results thus suggest that nurturing global feelings of self-determination, even if those feelings are anchored in various sources of motivations, might be the most desirable approach for secondary school students, at least when academic achievement is considered.

Fourth, associations between profile membership and students' expectations of success were more aligned with our expectations and with the diathesis-stress model (Guay et al., 2001), appearing to be driven both by students' global levels of self-determination and by their specific levels of identified regulation across upper elementary and secondary school samples. Indeed, in both samples, students' expectations of success were found to be highest (and equal) in *Strongly Motivated* and *Identified* profiles, followed by the *Amotivated* profile, and then by the *Non-Motivated* profile.

Finally, academic achievement levels were lower in secondary schools than in upper elementary schools for all students, with the exception of the *Strongly Motivated* ones. This observation is not surprising given that academic achievement tends to show decreasing developmental trajectories for most students (Gutman et al., 2003), which might be attributed to the increased educational demands associated with secondary education. Indeed, this discrepancy in achievement across educational levels can be expected because secondary education tends to be demanding, more competitive, and more difficult relative to upper elementary education. A recent study conducted in Serbia supports these assertions by showing that secondary school students tend to describe their educational environment as more demanding than upper elementary school students (Šakan, 2022). Romantic (Meier & Allen, 2008) and peer (McMahon et al., 2020) relationships also tend to become more important in secondary schools and might take time away from learning activities. What is, however, particularly interesting in our results is the observation that *Strongly Motivated* students might potentially be protected against this normative decrease, a hypothesis that will need to be more systematically verified in the context of true developmental (i.e., longitudinal) studies.

Perceived Parental Need Nurturing Behaviors and Students' Academic Motivation Profiles. Our result finally showed that students who felt exposed to higher global levels of parental need nurturing behaviors were more likely to belong to the most desirable *Strongly Motivated* and *Identified* profiles. These findings are consistent with SDT (Ryan and Deci, 2017) and prior variable-centered studies reporting positive associations between perceived need supportive behaviors and autonomous forms of motivation among upper elementary students (Domen et al., 2020) and adult employees (Olafsen et al., 2015).

Turning our attention to the youth's perceptions of specific need nurturing behaviors, which represent imbalances (i.e., deviations) from their perceived global levels of need nurturing behaviors (Gillet et al., 2019, 2020a), numerous associations were observed, most of which involved specific levels of perceived need thwarting behaviors. First, students who felt exposed to high levels of competence or autonomy thwarting behaviors were more likely to correspond to the *Strongly Motivated* profile. These results suggest that parental competence and autonomy thwarting behaviors might potentially contribute to increase students' levels of controlled motivation. Thus, competence and autonomy thwarting behaviors may lead students to overengage in their studies to avoid further experiences of negative feedback or controlling behaviors (i.e., external regulation) or to compensate for these negative experiences by restoring their self-esteem (i.e., introjected regulation; Tóth-Király et al., 2019a; Vansteenkiste & Ryan, 2013). This proposition aligns with the need restoration role of competence (Fang et al., 2018; Tóth-Király et al., 2020a; Radel et al., 2013) which suggests that people, in a setback situation characterized by need frustration, might come to invest more efforts into their activity. Likewise, by limiting students' sense of freedom, autonomy thwarting behaviors may lead them to see schooling as a way to escape their controlling parental environment (Tóth-Király et al., 2021a). When considering these interpretations, it is important to keep in mind that the *Strongly Motivated* profile was also characterized by high global levels of self-determination which, in line with our prior explanations, did not seem able to buffer the negative effects of controlled motivation (in this case the associations with autonomy and competence thwarting).

Second, students who felt exposed to higher levels of competence or relatedness thwarting behaviors were more likely to correspond to the *Amotivated* profile. On the one hand, when they feel exposed to negative parental feedback related to their performance, students may come to stop believing in their abilities, and thus decide that efforts will be unlikely to yield benefits. On the other hand, perceived exposure to overly distant or rejecting parents may directly contribute to undermining their academic motivation, possibly out of a desire to find other, more social, ways to restore this lack of relatedness support. Indeed, experiences of relatedness thwarting can easily translate into feelings of loneliness which have been shown to be related to decreased well-being (Tóth-Király et al., 2019b), maladaptive behaviors (Bőthe et al., 2018), or increased mortality (Luo et al., 2012), all of which are inconsistent with academic motivation.

Third, students who felt exposed to higher levels of relatedness support behaviors from their parents were also more likely to belong to the *Strongly Motivated* and *Amotivated* profiles relative to the *Non-Motivated* and *Identified,* profiles. This observation first supports the importance of social belonging and connectedness with others for the emergence of a *Strongly Motivated* profile. However, this result also suggest that caution is needed regarding the adoption of high levels of relatedness support behaviors, as these perceived behaviors also increased the risk of adopting an *Amotivated* profile. This second result suggests that when facing an overabundance (i.e., a high imbalance) of care, understanding and support, students may become complacent in their studies, knowing that their parental acceptance is not conditioned on their levels of academic performance and success.

Finally, higher perceived levels of inconsistency between paternal and maternal behaviors were found to increase the likelihood of students belonging to the *Amotivated* (relative to the *Strongly Motivated*) profile. These findings are consistent with the reported negative effect of parental inconsistency on youth (Dwairy, 2008; Knafo & Schwartz, 2003), suggesting that that mismatched parental behaviors might evoke ambivalence in students with respect to their academic motivation, possibly due to a perception that parents do not really know what they want. Overall, these results are aligned with the observation that perceived need nurturing interpersonal behaviors play a key role in the emergence of more desirable academic motivation configurations among upper elementary and secondary school students.

Practical Implications

From a practical perspective, the present study shows that it is possible to identify and target students who are likely to present undesirable motivational profiles. As these motivational profiles replicate across educational levels, it appears that intervention designed to nurture more desirable academic motivation profiles are likely to have similar effects across elementary and secondary levels of education. More specifically, our results suggest that parents should strive to communicate with children in a global need nurturing manner that incorporates autonomy, competence and relatedness support (Soenens et al., 2017), while avoiding behaviors likely to thwart the satisfaction of these needs. More specifically, autonomy support could be evoked by providing children with alternative choices and rational behind their activities, in conjunction with relying on informational and non-evaluative forms of communication (Reeve & Jang, 2006). Competence support could be achieved by setting optimal yet challenging tasks for students, establishing explicit rules and guidelines, as well as encouraging improvement. Finally, relatedness support occurs when parents show concern and care for children. Prior studies have supported the effectiveness of need nurturing interventions in a variety of contexts such as education (Stroet et al., 2013) or sports (Tessier et al., 2010). In line with SDT's (Ryan & Deci, 2017) propositions, need nurturing interpersonal behaviors could easily be used to elicit self-determined or autonomous motivations, which, in turn, may lead to positive implications.

At a higher (policy-based) level, the Serbian Strategy for the Development of Education (with a plan reaching to 2030) recognizes the importance of determining school success factors as a main priority. Up until this point, the majority of Serbian rules and regulations focused on the educational system itself, and on the teachers. Our results shows that parents are also essential factors when it comes to understanding youth's academic motivation, and that their support is one of the main determinants of students' educational success. As such, our findings should inform policy-related decisions about the value of academic motivation profiles and the importance of parental need supportive behaviors (and how to nurture them) as key drivers of these profiles.

Limitations and Future Directions

Several limitations have to be acknowledged when interpreting our findings. First, the cross-sectional design adopted in this study precludes causal inferences and makes it impossible to establish the directionality of the observed associations between the profiles, their outcomes, and their predictors. Future longitudinal studies will be needed to document this directionality, and to assess the within-person and within-sample stability of the profiles observed in the present study (Kam et al., 2016). Second, this study relied on self-reported measures, which are prone to a variety of biases. As a result, future research should strive to incorporate more objective indicators (e.g., actual dropout, standardized test scores, and school records of achievement) as well as multi-informant data (e.g., from teachers or parents). As part of our description of the sample, we relied on students' estimation of their parents' income based on a simple homemade measure (below average, average, above average) of unknown psychometric properties. For this reason, the descriptive statistics extracted from this measure should be considered with caution and only as a rough description of parental income.

Third, relying on single-item measures for our outcomes is also a limitation of our research. However, high correlations have been reported between self-reported grades and actual school grades (Kuncel et al., 2005), giving us some confidence about the validity of these self-reports. Fourth, although the replication of our results across samples of upper elementary and secondary students recruited via randomized sampling procedures is a strength of our study, the true representativity of our sample in relation to the Serbian population remains unknown. Moreover, the generalizability of these results beyond Serbia also remains uncertain. It would thus be important to replicate these results among students from other cultural, educational, and socio-economic backgrounds. Fifth, the outcomes and predictors of the observed motivation profiles still need to be more thoroughly documented in future research incorporating a more diverse set of outcomes (e.g., wellbeing, distress, vocational choices and aspirations, engagement, educational attainment) and predictors (e.g., need fulfillment, self-esteem, school workload, perceived teacher behaviors).

Conclusion

This study was designed to identify different profiles of academic motivation in Serbian upper-elementary and secondary school students, relying on a current state-of-the-art (Howard et al., 2018, 2020) multidimensional global/specific representation of their academic motivation. It also sought to identify their relations to theoretically relevant predictors and outcomes. Four profiles (*Non-Motivated*, *Identified*, *Amotivated*, and *Highly Motivated*) displaying differential levels of global and specific academic motivation were identified. These profiles were fully replicated across educational levels. Profile membership was predicted by perceived global levels of need-nurturing parental behaviors, as well as by some specific parental need-nurturing behaviors, and these associations were the same across educational levels. Finally, most profiles differed from one another in terms of outcomes, although there were some differences across educational levels.

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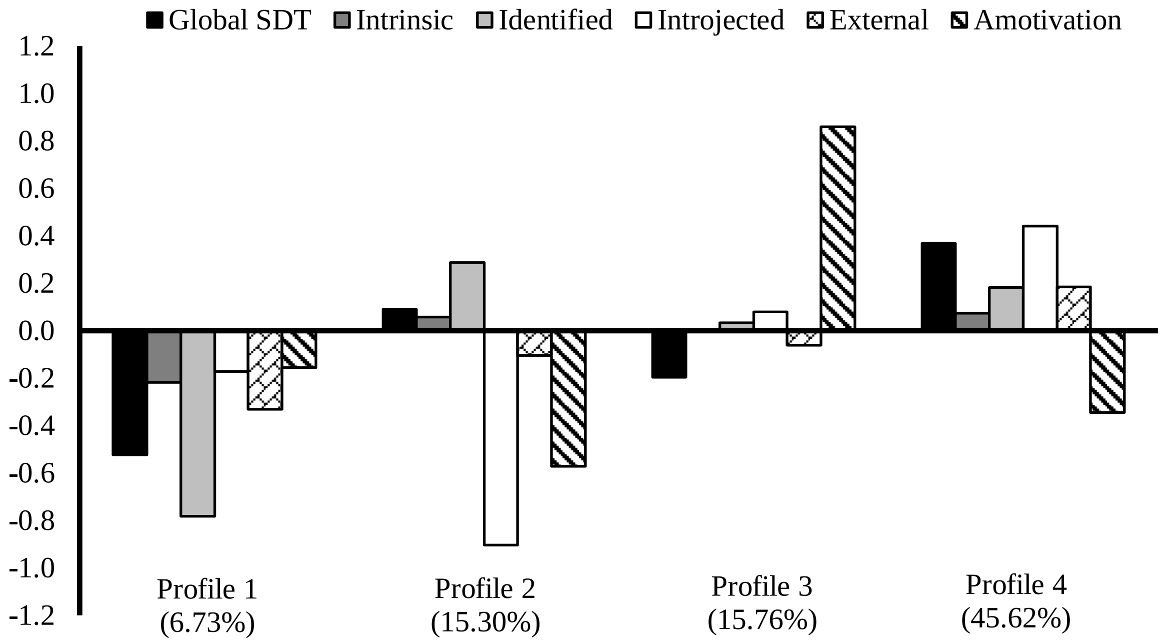

Figure 1
Final 4-Profile Solution

Note. Profile indicators were standardized factor scores (M = 0, SD = 1) derived from preliminary measurement models; SDT: Self-determined motivation; Profile 1: Non-Motivated; Profile 2: Identified; Profile 3: Amotivated; Profile 4: Strongly Motivated.

Table 1

Model Fit Results from the Latent Profile Analyses

Model	LL	#fp	Scaling	AIC	CAIC	BIC	SSABIC	Entropy	aLMR	BLRT
Latent Profile Analysis (Upper Elementary Level)										
1 profile	-5277.368	12	.980	10578.736	10646.663	10634.663	10596.557	Na	Na	Na
2 profiles	-5221.354	19	1.086	10480.707	10588.258	10569.258	10508.924	.507	< .001	< .001
3 profiles	-5190.205	26	1.100	10432.409	10579.584	10553.584	10471.022	.725	.032	< .001
4 profiles	-5168.567	33	1.313	10403.134	10589.933	10556.933	10452.141	.662	.543	< .001
5 profiles	-5147.346	40	1.304	10374.693	10601.116	10561.116	10434.096	.659	.329	< .001
6 profiles	-5127.951	47	1.304	10349.902	10615.949	10568.949	10419.701	.681	.307	< .001
7 profiles	-5111.868	54	1.158	10331.737	10637.408	10583.408	10411.931	.754	.223	< .001
8 profiles	-5092.977	61	1.151	10307.955	10653.250	10592.250	10398.545	.743	.551	< .001
Latent Profile Analysis (Secondary Level)										
1 profile	-3101.581	12	.981	6227.162	6288.918	6276.918	6238.833	Na	Na	Na
2 profiles	-3065.365	19	1.011	6168.730	6266.510	6247.510	6187.209	.723	< .001	< .001
3 profiles	-3031.388	26	1.120	6114.776	6248.581	6222.581	6140.063	.712	.027	< .001
4 profiles	-3008.012	33	1.236	6082.024	6251.853	6218.853	6114.118	.659	.320	< .001
5 profiles	-2988.850	40	1.182	6057.700	6263.554	6223.554	6096.602	.692	.126	< .001
6 profiles	-2976.617	47	1.214	6047.234	6289.112	6242.112	6092.944	.704	.471	.020
7 profiles	-2962.882	54	1.252	6033.764	6311.666	6257.666	6086.282	.711	.486	< .001
8 profiles	-2952.285	61	1.340	6026.570	6340.496	6279.496	6085.895	.724	.713	.200
Profile Similarity										
Configural similarity	-9001.697	67	1.271	18137.394	18548.057	18481.057	18268.235	.774	Na	Na
Structural similarity	-9043.446	43	1.134	18172.893	18436.453	18393.453	18256.865	.724	Na	Na
Dispersion similarity	-9047.177	37	1.150	18168.354	18395.138	18358.138	18240.609	.720	Na	Na
Distributional similarity	-9054.555	34	1.164	18177.111	18385.507	18351.507	18243.507	.716	Na	Na
Explanatory Similarity										
Free relations with outcomes	-5458.918	22	1.456	10961.835	11096.680	11074.680	11004.798	.735	Na	Na
Equal relations with outcomes	-5782.576	14	1.187	11593.151	11678.962	11664.962	11620.491	.707	Na	Na
Partially equal relations with outcomes	-5473.121	17	1.450	10980.243	11084.441	11067.441	11013.441	.737	Na	Na
Predictive Similarity										
Free relations with predictors	-2369.824	52	1.059	4843.648	5162.372	5110.372	4945.196	.662	Na	Na
Equal relations with predictors	-2380.001	28	1.026	4816.002	4987.622	4959.622	4870.681	.656	Na	Na

Note. LL: loglikelihood; fp: number of free parameters; AIC: Akaike Information Criterion; CAIC: Consistent AIC; BIC: Bayesian Information Criterion; SSABIC: Sample-Size Adjusted BIC; aLMR: p-value associated with the adjusted Lo-Mendel-Rubin likelihood ratio test; BLRT: Bootstrap Likelihood Ratio Test; Na: not applicable.

Table 2

Associations between Profile Memberships and Outcomes (Partial Explanatory Similarity)

Outcome	Profile 1 Mean [95% CI]	Profile 2 Mean [95% CI]	Profile 3 Mean [95% CI]	Profile 4 Mean [95% CI]	Differences between profiles
Achievement (elementary level)	-.534 [-.797, -.270]	.745 [.677, .813]	.485 [.377, .593]	.596 [.527, .664]	1 < 3 = 4 < 2
Achievement (secondary level)	-2.008 [-2.090, -1.926]	-.745 [-.944, -.546]	-1.178 [-1.625, -.730]	.596 [.527, .664]	1 < 2 = 3 < 4
Expectations of success	-1.424 [-1.730, -1.119]	.459 [.368, .550]	.084 [-.101, .269]	.389 [.301, .478]	1 < 3 < 2 = 4

Note. SE: Standard error; Outcomes are factor scores estimated in standardized units (M = 0, SD = 1); Profile 1: Non-Motivated; Profile 2: Identified; Profile 3: Amotivated; Profile 4: Strongly Motivated.

Table 3

Effects of Youth's Perceptions of Parents Need-Nurturing Behaviors on Profile Membership (Predictive Similarity)

Outcomes	Profile 1 vs. Profile 2		Profile 1 vs. Profile 3		Profile 1 vs. Profile 4	
	Coeff. (SE)	OR	Coeff. (SE)	OR	Coeff. (SE)	OR
General need nurturing	-.508 (.173)**	.602	-.263 (.176)	.769	-.821 (.181)**	.440
Specific autonomy support	-.198 (.195)	.820	-.300 (.194)	.741	-.355 (.195)	.701
Specific competence support	-.342 (.253)	.710	-.216 (.191)	.806	-.368 (.206)	.692
Specific relatedness support	.053 (.221)	1.054	-.593 (.176)**	.553	-.432 (.207)*	.649
Specific autonomy thwarting	.120 (.200)	1.127	-.191 (.194)	.826	-.462 (.193)*	.630
Specific competence thwarting	.115 (.222)	1.122	-1.005 (.215)**	.366	-.592 (.214)**	.553
Specific relatedness thwarting	-.340 (.242)	.712	-.665 (.665)**	.514	-.283 (.212)	.754
Inter-parent inconsistency	-.401 (.337)	.670	-.424 (.288)	.654	.059 (.304)	1.061
	Profile 2 vs. Profile 3		Profile 2 vs. Profile 4		Profile 3 vs. Profile 4	
	Coeff. (SE)	OR	Coeff. (SE)	OR	Coeff. (SE)	OR
General need nurturing	.245 (.142)	1.278	-.313 (.155)*	.731	-.558 (.140)**	.572
Specific autonomy support	-.102 (.184)	.903	-.157 (.203)	.855	-.055 (.140)	.946
Specific competence support	.126 (.228)	1.134	-.026 (.269)	.974	-.152 (.166)	.859
Specific relatedness support	-.647 (.200)**	.524	-.485 (.247)*	.616	.162 (.155)	1.176
Specific autonomy thwarting	-.312 (.175)	.732	-.582 (.189)**	.559	-.271 (.138)*	.763
Specific competence thwarting	-1.120 (.204)**	.326	-.708 (.221)**	.493	.413 (.159)**	1.511
Specific relatedness thwarting	-.325 (.196)	.723	.057 (.228)	1.059	.382 (.161)*	1.465
Inter-parent inconsistency	-.023 (.284)	.977	.460 (.330)	1.584	.483 (.239)*	1.621

Note. * $p < .05$; ** $p < .01$; Predictors are factor scores estimated in standardized units (M = 0, SD = 1); Profile 1: Non-Motivated; Profile 2: Identified; Profile 3: Amotivated; Profile 4: Strongly Motivated; OR: odds ratio. The coefficients and OR reflects the effects of the predictors on the likelihood of membership into the first listed profile relative to the second listed profile.

Online Supplements for:

Nature, Implications and Determinants of Academic Motivation Profiles among Upper Elementary and Secondary Students

These online supplements are to be posted on the journal website and hot-linked to the manuscript. If the journal does not offer this possibility, these materials can alternatively be posted on one of our personal websites (we will adjust the in-text reference upon acceptance).

We would also be happy to have some of these materials brought back into the main manuscript, or included as published appendices if you deem it useful. We developed these materials to provide additional technical information and to keep the main manuscript from becoming needlessly long.

Appendix 1
Preliminary Measurement Models

Analyses

Models Specification

Preliminary measurement models were estimated to verify the psychometric properties of our measures of academic motivation and need nurturing parental behaviors, and to obtain factor scores for our main analyses. In comparison to manifest scale scores (i.e., the summary or the average of scores), factor scores have the advantage of preserving the nature of the measurement model (e.g., bifactor, invariance) and of maintaining a partial control for unreliability (e.g., Morin et al., 2016b; 2016c, 2017; Skrondal & Laake, 2001). Importantly, mixture models (including latent profile analyses) are generally often too complex to be estimated using fully latent factors (McLarnon et al., 2021; Morin et al., 2020), and could not have been estimated in this manner in the present study given that our exploratory structural equation modeling approach to measurement has not yet been combined with mixture modeling.

Academic motivation. Theoretical (Howard et al., 2020) and empirical (Howard et al., 2018; Litalien et al., 2017) considerations have supported the relevance of the bifactor exploratory structural equation modeling (bifactor-ESEM; Morin et al., 2016a, 2020) to accurately represent the underlying factor structure of motivation measures anchored in self-determination theory (SDT; Ryan & Deci, 2017). The bifactor component makes it possible to obtain a direct reflection of students' global levels of academic self-determination in the form of a global (G-) factor defined by all motivation items with factor loadings matching their theoretical position on the SDT motivation continuum (strong positive loadings from the intrinsic motivation items, moderate positive loadings from the identified regulation items, small positive loadings from the introjected regulation items, null or negative loadings from the external regulation items, and strong negative loadings from the amotivation items). In addition to this G-factor, this bifactor component also makes it possible to obtain non-redundant specific (S-) estimates of the unique quality of each motivational subscale left unexplained by the G-factor (Howard et al., 2018, 2020; Litalien et al., 2017). In contrast, the ESEM component makes it possible to account for the normative degree of conceptual overlap between the specific factors with the free estimation of item-level cross-loadings (targeted to be as close to zero as possible using a confirmatory target rotation approach; Morin et al., 2020). The importance of this ESEM component is underscored by previous studies (for a review, see Asparouhov et al., 2015) showing the incorporation of cross-loadings results in more accurate factor definition, whereas the inclusion of unnecessary cross-loadings does not result in biased estimates of the factors.

A total of four alternative motivation measurement models were estimated: (1) a correlated factors confirmatory factor analytic (CFA) solution (items were only associated to their a priori factors, cross-loadings were set to be zero, and factors were allowed to freely correlate with one another); (2) a correlated factors ESEM solution (defined as the CFA solution, while freely estimating all cross-loadings but targeting them to be close to zero using a confirmatory oblique target rotation procedure); (3) a bifactor-CFA solution (defined as the CFA solution, but incorporating a G-factor defined by all indicators, and assuming the orthogonality of all factors); and (4) a bifactor-ESEM solution (defined as the bifactor-CFA solution, while freely estimating all cross-loadings between the S-factors but targeting to be close to zero via a confirmatory orthogonal target rotation procedure).

Following recommendations from Morin and colleagues (Morin et al., 2016b, 2017, 2020), model selection was anchored in the comparison of model fit and parameter estimates associated with each of these four models. The first comparison pertains to the correlated factors CFA and ESEM solutions. Support for the ESEM solution comes from the observation of equally well-defined and reliable factors, multiple cross-loadings, as well as reduced factor correlations. The optimal correlated factors solution is then compared to its bifactor counterpart. In this second comparison, the bifactor solution is supported when it results in an equal or improved model fit, a well-defined and reliable self-determination motivation G-factor (matching the continuum structure of motivation: Howard et al., 2018; Litalien et al., 2017), together with at least some well-defined and reliable S-factors. The four measurement models were first estimated separately for upper elementary and secondary levels.

Parental need nurturing behaviors. Given that we had information on mothers' and fathers' need nurturing behaviors, it was possible to consider them globally (i.e., across parents), or separately to examine the unique contribution of each parent (Ratelle et al., 2018). This decision should be anchored in an examination of the overlap between their interpersonal behaviors. As suggested by Ratelle et al. (2018), minimally sufficient convergence between maternal and paternal scores on matching factors (e.g., maternal autonomy support and paternal autonomy support) suggests that they should be treated as a unity, whereas a lack of commonality would suggest that they should be treated separately. As mothers' and father's interpersonal behaviors showed a high degree of overlap (correlations between matching factors ≥ .600), measurement models were specified to consider the need nurturing behaviors expressed jointly by both parents.

Multiple informant data, with substantial commonalities between informants, is typically modeled via correlated trait-correlated method (minus one) [CT-C(M-1)] models (Eid, 2000; Eid et al., 2008), which are extensions of classical multitrait-multimethod models (MTMM; Campbell & Fiske, 1959). The advantage of these models is their ability to distinguish what is common to the constructs being assessed (autonomy support, competence support, etc.) from the uniquenesses of the different sources of evaluation (i.e., mothers or fathers), thus making it possible to test the relative contribution of these two components to the prediction of students' profile membership. In the present study, these CT-C(M-1) models incorporated one method factor, defined from the ratings related to one type of parent (the father in this study), to reflect inconsistencies between the ratings associated with both parents.

In addition to this CT-C(M-1) specification, we followed recent empirical evidence supporting the value of adopting a bifactor-ESEM representation of need nurturing behaviors (e.g., Tóth-Király et al., 2020). As for the measure of academic motivation, four alternative measurement models were contrasted: (1) a correlated factor CFA solution (including neither cross-loadings nor a G-factor); (b) a correlated factor ESEM solution (including cross-loadings but no G-factor); (c) bifactor-CFA solution (including one global need nurturing G-factor but no cross-loadings); and (d) our a priori bifactor-ESEM solution (including one global need nurturing G-factor and cross-loadings between the S-factors). Model selection was based on the same guidelines (Morin et al., 2016b, 2017; 2020). A priori correlated uniquenesses (CUs) were added to these models to reflect the use of identical items for ratings of mothers' and fathers' need nurturing behaviors.

Tests of Measurement Invariance and Differential Item Functioning

To ensure that we relied on a comparable set of factor scores across educational levels, we conducted tests of measurement invariance on the optimal solution for academic motivation. These tests were performed in the following sequence (Millsap, 2011): (1) configural invariance (equal factor structure), (2) weak invariance (equal factor structure and loadings), (3) strong invariance (equal factor structure, loadings, and thresholds), (4) strict invariance (equality of factor structure, loadings, thresholds, and uniquenesses); (5) invariance of the latent variance-covariance matrix (equality of factor structure, loadings, thresholds, uniquenesses, and latent variances and covariances); and (6) latent means invariance (equality of factor structure, loadings, thresholds, uniquenesses, latent variances and covariances, and latent means).

Due to convergence issues associated with the complex parental need nurturing measurement model, tests of differential item functioning (DIF; measurement non-invariance) were conducted by way of multiple indicators multiple causes (MIMIC) models (e.g., Morin et al., 2013; Tóth-Király et al., 2018) to ensure the comparability of this model across samples of upper elementary and secondary school students. In this approach, the latent factors are regressed on school level (coded as a binary variable with elementary = 0 and secondary = 1), and DIF is identified when direct relations are observed between predictors and item responses over and above the effects of the predictors on the latent factors. Three alternative MIMIC models thus need to be contrasted: (1) a null model (i.e., the paths from the predictor to the items and factors are constrained to be zero); (2) a saturated model (i.e., the paths from the predictor to the items are freely estimated, but the paths from the predictor to the factors are constrained to be zero); and (3) an invariant model (i.e., the paths from the predictor to the factors are freely estimated, but the paths from the predictor to the items are constrained to be zero). Comparing the model fit of the null model with the saturated and invariant models reveals whether school level had an effect on item responses, whereas comparing the fit of the saturated and invariant models reveals whether this effect is limited to the latent factors or indicative of DIF.

Model Estimation

All preliminary models were estimated using Mplus 8.4 (Muthén & Muthén, 2017) and the robust weighted least squares mean- and variance-adjusted (WLSMV) estimator which is superior to maximum-likelihood estimators (robust or not) in the presence of ordered-categorical responses following asymmetric thresholds (for a review, see Finney & DiStefano, 2013) as in the present study.

Measurement models were evaluated using typical goodness-of-fit indices (Hu & Bentler, 1999; Marsh et al., 2005): the chi-square test (χ^2), the comparative fit index (CFI), the Tucker-Lewis Index (TLI), and the root mean square error of approximation (RMSEA). CFI and TLI values are considered to be adequate or excellent when they are above .90 and .95, respectively. RMSEA values are considered to be adequate or excellent below .08 and .06, respectively. As the chi-square test is known to be oversensitive to minor misspecifications and sample size (Marsh et al., 2005), it is simply reported to ensure transparency, but not used for model evaluation and comparisons. Nested models' comparisons in tests of measurement invariance and DIF were based on examination of changes (Δ) in fit indices where a decrease of .010 or higher for CFI and TLI and an increase of at least .015 or higher for RMSEA indicates a lack of invariance (Chen, 2007; Cheung & Rensvold, 2002). Finally, we also calculated model-based omega (ω) coefficients of composite reliability (McDonald, 1970) to assess the reliability of the factors (Morin et al., 2020).

Results

Academic Motivation

The results associated with the academic motivation models estimated in the upper elementary school sample are reported in Tables S1 (goodness-of-fit), S2 (CFA and ESEM solutions), S3 (CFA and ESEM factor correlations), and S4 (Bifactor-ESEM solution). These results first show that the correlated factors ESEM resulted in a substantially higher level of fit than the correlated factors CFA (ΔCFI = +.041, ΔTLI = +.041, ΔRMSEA = -.026). Parameter estimate results show that four (i.e., intrinsic, introjected, external, amotivation) out of the five factors were well-defined (λ = .440 to .930, M = .649) and reliable (ω = .707 and .841) in ESEM, but that the identified regulation factor retained a lower level of definition and reliability (ω = .453) as it was mainly defined by two items (λ_{17} = .451, λ_{24} = .431), while the other two items displayed lower target loadings (λ_3 = -.129, λ_{10} = .189), but higher cross-loadings on the external regulation (λ_3 = .407, λ_{10} = .350) and intrinsic motivation (λ_3 = .387, λ_{10} = .296) factors. These cross loadings suggest that these items may better tap into students' global levels of self-determination than into their specific levels of identified regulation. The presence of multiple statistically significant cross-loadings (40 out of the 80 cross-loadings) also suggests the presence of a self-determination G-factor. Finally, factor correlations were also reduced in the ESEM ($|r|$ = .146 to .494, M = .350) relative to CFA ($|r|$ = .161 to .859, M = .575) solution.

The correlated factors ESEM solution was thus retained and contrasted with its bifactor counterpart. This bifactor-ESEM solution resulted in a slightly improved level of fit to the data (ΔCFI = +.004, ΔTLI = +.006, ΔRMSEA = -.006), and revealed a reliable (ω = .918) G-factor well-defined by factor loadings matching the SDT continuum: Intrinsic (λ = .663 to .763, M = .685), identified (λ = .522 to .656, M = .596), introjected (λ = .228 to .486, M = .377), external (λ = .200 to .569, M = .371), and amotivation (λ = -.323 to -.498, M = -.417) items. Likewise, the S-factors related to introjected regulation (λ = .381 to .681, M = .579; ω = .749), external regulation (λ = .498 to .667, M = .579; ω = .771), and amotivation (c) were well-defined. In contrast, the S-factors related to intrinsic motivation (λ = -.262 to .230, M = .161; ω = .180) and identified regulation (λ = .197 to .403, M = .308; ω = .486) retained a more limited amount of specificity.

The results associated with the academic motivation models estimated in the secondary school sample are reported in Tables S1 (goodness-of-fit), S3 (CFA and ESEM factor correlations), S5 (CFA and ESEM solutions), and S6 (bifactor-ESEM solution). These results match those obtained among upper elementary students, and thus also support the superiority of the bifactor-ESEM solution. To more precisely assess the extent to which results from this solution were replicated across the two samples, tests of measurement invariance across samples (upper elementary *vs* secondary) were conducted on this solution. The results from these tests (reported in Table S1), support the complete measurement invariance of this solution (ΔCFI/TLI $\leq$ .010, ΔRMSEA $\leq$ .015). The final parameter estimates from the model of latent mean invariance are reported in Table S7 and match those described above for the bifactor-ESEM solution. More specifically, the self-determined motivation G-factor was well-defined and reliable (λ = -.416 to .673, M = .416, ω = .891) and associated with factor loadings that matched the hypothesized SDT continuum: Intrinsic (λ = .596 to .673, M = .639), identified (λ = .436 to .575, M = .500), introjected (λ = .155 to .422, M = .325), external (λ = .043 to .459, M = .277), and amotivation (λ = -.295 to -.416, M = -.338) items. With respect to the S-factors, identified regulation (λ = .399 to .639, M = .464; ω = .688), introjected regulation (λ = .397 to .692, M = .590; ω = .753), external regulation (λ

= .536 to .659, *M* = .603; ω = .779) and amotivation (λ = -.578 to -.770, *M* = -.682; ω = .826) were also generally well-defined, while the intrinsic motivation S-factor retained a more limited amount of specificity (λ = -.019 to .405, *M* = .239; ω = .336). This suggests that, in this final model, ratings of intrinsic motivation only retained a limited amount of specificity once their contribution to the definition of the G-factor has been taken into account. Factor scores were saved from this model.

Perceived Interpersonal Behaviors

Goodness-of-fit indices associated with the alternative measurement models estimated on the total sample are reported in Table S1. Starting with the examination of the correlated factors solutions, ESEM demonstrated a higher level of fit than CFA (ΔCFI = +.028, ΔTLI = +.029, ΔRMSEA = -.017). The comparison of parameter estimates, reported in Table S8 (CFA) and S9 (ESEM) revealed that both solutions resulted in well-defined and reliable factors (CFA: λ = .274 to .875, *M* = .657, ω = .839 to .906; ESEM: λ = .179 to .815, *M* = .498, ω = .762 to .882) as well as in a similarly well-defined and reliable inconsistency factor (CFA: λ = -.449 to .580, *M* = .389, ω = .879; ESEM: λ = -.470 to .545, *M* = .388, ω = .896). Although the ESEM solution does incorporate multiple statistically significant cross-loadings (some of which were higher than their corresponding target loadings), none of them were large enough to undermine the definition of the factors. Still, observing a relatively high number of cross-loadings on multiple factors suggests that these items may tap into global levels of need nurturing behaviors instead of their specific dimensions. When looking at the factor correlations reported in Table S10, these were reduced in the ESEM (|*r*| = .059 to .538, *M* = .348), relative to the CFA (|*r*| = .406 to .865, *M* = .594), solution, and appropriately positive among the same valenced factors (support-support) and negative among factors with an opposite valence (support-thwarting).

The correlated factors ESEM representation of the data was thus retained and contrasted with its bifactor alternative. While improvements in model fit were negligible (ΔCFI = +.002, ΔTLI = +.002, ΔRMSEA = -.002), results pertaining to this bifactor-ESEM revealed a well-defined and reliable G-factor (ω = .975), reflecting an underlying continuum of perceived need nurturing behaviors with positive factor loadings associated with the need support items (λ = .267 to .737, *M* = .570) and negative factor loadings associated with the need thwarting item (λ = -.395 to -.783, *M* = .579). Finally, although the S-factors appeared to be more weakly defined than in the correlated factors ESEM solution (autonomy support: λ = .209 to .536, *M* = .391, ω = .763; competence support: λ = .149 to .515, *M* = .315, ω = .627; relatedness support: λ = .077 to .496, *M* = .267, ω = .587; autonomy thwarting: λ = .336 to .593, *M* = .442, ω = .780; competence thwarting: λ = .119 to .543, *M* = .343, ω = .729; relatedness thwarting: λ = .081 to .500, *M* = .322, ω = .675; method factor: λ = .021 to .370, *M* = .178, ω = .650), they still retained a meaningful levels of specificity (associated with ω values greater than .500; see Perreira et al., 2018; Morin et al., 2020).

Finally, starting from the bifactor-ESEM solution, we incorporated school level as predictor to test for the presence of DIF. The results from these analyses are reported in the bottom section of Table S1 and first reveal that the null model had adequate fit to the data. Although the fit of the saturated (ΔCFI = +.007, ΔTLI = +.010, ΔRMSEA = -.007) and invariant (ΔCFI = +.008, ΔTLI = +.011, ΔRMSEA = -.008) models was slightly higher, these differences remained within acceptable ranges, suggesting the adequacy of the null model and a lack of DIF. This conclusion was supported by the inspection of parameter estimates revealing a lack of substantial effects of school level on the items or the factors. Factor scores were thus saved from this model for the main analyses. Correlations among all factor scores are reported in Table S12.

Appendix 2
Selecting the Optimal Number of Profiles

Model Selection and Comparison

When selecting the optimal number of profiles, we considered the meaning, the theoretical conformity, and the statistical adequacy of the solutions, as well as various statistical indicators (e.g., Morin et al., 2020a): The Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), the Consistent AIC (CAIC), the Sample-Size-Adjusted BIC (SSABIC), the adjusted Lo-Mendell-Rubin (aLMR) likelihood ratio test, and the Bootstrap Likelihood Ratio Test (BLRT). Lower values on these four indicators suggest a better fitting solution, whereas a non-significant p-value for aLMR and BLRT suggests the superiority of a model including one less profile. As the AIC, BIC, CAIC, and SSABIC often keep improving when adding profiles, the graphical examination of “elbow plots” facilitates this process where a plateau on these plots suggest that the optimal number of profiles have been reached (Morin et al., 2020a). Simulation studies have supported the performance of the CAIC, BIC, SSABIC, and BLRT, but not that of the AIC and aLMR, as reliable indicators of the optimal number of profiles (e.g., Diallo et al., 2016, 2017; Peugh & Fan, 2013). To ensure full disclosure and comparability with prior studies, we report all indicators, but put more emphasis on CAIC/BIC or SSABIC/BLRT depending on the classification accuracy. Entropy (i.e., classification accuracy) is also reported with values ranging from 0 (low) to 1 (high).

Results

Results from the alternative sample-specific LPA solutions are reported in the upper section of Table 1 of the main manuscript. Overall, the information criteria converged on different solutions. Thus, whereas the SSABIC kept on decreasing with the inclusion of additional profiles in both samples, the CAIC and BIC reached their minimum at the three-profile solution in the upper elementary sample, and at the three- (CAIC) or four- (BIC) profile solution in the secondary sample. Finally, the BLRT failed to converge on any specific solution in the upper elementary sample but supported the seven-profile solution in the secondary sample. An examination of the elbow plots (reported in Figure S2 of the online supplements) revealed a plateau around three or four profiles for the CAIC and BIC in both samples. For the SSABIC, the elbow plots suggest a first inflexion point around three profiles, and a second one around five-six profiles, for both samples. On this basis, solutions including three to six profiles were carefully examined. This inspection revealed that all solutions were proper statistically, highly similar across educational levels (thus providing early evidence of configural similarity), and that increasing the number of profiles resulted in interpretable, theoretically meaningful, and distinct profiles up to the four-profile solution. In contrast, adding a fifth or sixth profile did not bring addition information but rather led to the creation of smaller profiles with similar shape to existing ones. The four-profile solution was thus retained for both samples, supporting its configural similarity.

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Table S1

Goodness-of-Fit Statistics for the Estimated Measurement Models

	χ^2	df	CFI	TLI	RMSEA (90% CI)	$\Delta\chi^2$	Δdf	ΔCFI	ΔTLI	ΔRMSEA
Academic Motivation (Upper Elementary Level)										
Correlated factors CFA	642.692*	160	.948	.938	.062 (.057, .067)					
Correlated factors ESEM	199.879*	100	.989	.979	.036 (.029, .043)					
Bifactor CFA	675.810*	150	.943	.928	.067 (.062, .072)					
Bifactor ESEM	146.688*	85	.993	.985	.030 (.022, .039)					
Academic Motivation (Secondary Level)										
Correlated factors CFA	518.814*	160	.941	.930	.069 (.063, .076)					
Correlated factors ESEM	206.930*	100	.982	.966	.048 (.039, .057)					
Bifactor CFA	560.664*	150	.932	.914	.077 (.070, .083)					
Bifactor ESEM	147.551*	85	.990	.977	.040 (.029, .050)					
Perceived Parenting										
CT-C(M-1) CFA	2859.653*	1017	.963	.959	.038 (.036, .040)					
CT-C(M-1) ESEM	1233.992*	807	.991	.988	.021 (.018, .023)					
CT-C(M-1) Bifactor CFA	4072.176*	984	.938	.929	.050 (.049, .052)					
CT-C(M-1) Bifactor ESEM	1106.574*	765	.993	.990	.019 (.016, .021)					
Tests of Measurement Invariance (Motivation)										
Configural invariance	294.655*	170	.992	.982	.034 (.028, .041)					
Weak invariance	405.679*	254	.990	.985	.031 (.025, .036)	142.773*	84	-.002	+.003	-.003
Strong invariance	448.765*	308	.991	.989	.027 (.021, .032)	73.019	54	+.001	+.004	-.004
Strict invariance	509.395*	328	.988	.986	.030 (.025, .035)	54.634	20	-.003	-.003	+.003
Latent variance-covariance invariance	441.974*	349	.994	.992	.021 (.014, .026)	27.654	21	+.006	+.006	-.009
Latent mean invariance	471.137*	355	.992	.992	.023 (.017, .028)	16.675	6	-.002	.000	+.002
MIMIC Models (Perceived Parenting)										
Null	1569.283*	813	.985	.978	.027 (.025, .029)					
Saturated	1161.189*	765	.992	.988	.020 (.018, .023)	215.557*	48	+.007	+.010	-.007
Invariant	1170.418*	805	.993	.989	.019 (.017, .021)	81.433*	8	+.008	+.011	-.008

Note. * $p < .05$; ** $p < .01$; CFA: Confirmatory factor analysis; ESEM: Exploratory structural equation modeling; CT-C(M-1): Correlated trait correlated method minus one model; MIMIC: Multiple indicators multiple causes model; χ^2: Robust chi-square test of exact fit; df: Degrees of freedom; CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root mean square error of approximation; 90% CI: 90% confidence interval of the RMSEA; Δ: change in model fit in relation to the comparison model.

Table S2

Standardized Parameter Estimates from the Correlated Factors CFA and ESEM Solutions for the Academic Motivation Scale for Upper Elementary Level

	CFA		ESEM					
	Factor (λ)	δ	Intrinsic (λ)	Identified (λ)	Introjected (λ)	External (λ)	Amotivation (λ)	δ
Intrinsic motivation								
Item 2	.595**	.646	**.637****	-.157**	.136**	-.044	-.139**	.500
Item 9	.684**	.531	**.440****	.066	.188**	.048	-.122**	.573
Item 16	.672**	.548	**.544****	.265**	.036	.011	.015	.535
Item 23	.767**	.412	**.548****	.422**	.169**	-.190**	-.078*	.344
ω	.776		.707					
Identified motivation								
Item 3	.643**	.587	.387**	**.129**	.099*	.407**	-.028	.501
Item 10	.706**	.502	.296**	**.189****	-.064	.350**	-.158**	.492
Item 17	.755**	.431	.262**	**.451****	-.009	.327**	.008	.378
Item 24	.788**	.380	.280**	**.431****	.075*	.188**	-.124**	.371
ω	.815			.453				
Introjected motivation								
Item 7	.625**	.609	.130**	-.196**	**.681****	.073	.090*	.503
Item 14	.736**	.459	.131*	-.007	**.464****	.192**	-.026	.581
Item 21	.590**	.652	-.091	.063	**.759****	-.038	.094**	.452
Item 28	.856**	.268	.057	.002	**.816****	-.029	-.104**	.280
ω	.799				.803			
External motivation								
Item 1	.575**	.670	.002	-.040	-.014	**.703****	.048	.549
Item 8	.874**	.236	.157**	.072	.057	**.626****	-.097*	.331
Item 15	.749**	.439	-.089	.161**	.082*	**.572****	-.195**	.459
Item 22	.593**	.648	-.353**	.277**	.259**	**.605****	.058	.398
ω	.796					.783		
Amotivation								
Item 5	.725**	.474	-.203**	-.019	.037	.063	**.600****	.523
Item 12	.625**	.609	.022	-.015	.092*	-.078	**.613****	.607
Item 19	.809**	.345	.041	.026	-.010	.013	**.844****	.334
Item 26	.839**	.297	.123**	.002	-.033	.016	**.930****	.226
ω	.839						.841	

Note. *p < .05; **p < .01; CFA: Confirmatory factor analysis; ESEM: Exploratory structural equation modeling; λ: Factor loading; δ: Item uniqueness; ω: model-based omega composite reliability based on McDonald (1970); Target factor loadings are in bold.

Table S3

Latent Factor Correlations from the Correlated Factors CFA (below the diagonal) and ESEM (above the diagonal) Solutions for the Academic Motivation Scale

	Intrinsic	Identified	Introjected	External	Amotivation
Upper Elementary Level					
Intrinsic motivation	—	.273**	.340**	.494**	-.453**
Identified regulation	.859**	—	.378**	.364**	-.296**
Introjected regulation	.606**	.590**	—	.426**	-.146**
External regulation	.624**	.847**	.616**	—	-.331**
Amotivation	-.538**	-.531**	-.161**	-.381**	—
Secondary Level					
Intrinsic motivation	—	.407**	.395**	.278**	-.310**
Identified regulation	.820**	—	.350**	.237**	-.454**
Introjected regulation	.582**	.523**	—	.362**	-.137**
External regulation	.460**	.707**	.648**	—	-.265**
Amotivation	-.462**	-.544**	-.162**	-.453**	—

Note. $^{*}p < .05$; $^{**}p < .01$; CFA: Confirmatory factor analysis; ESEM: Exploratory structural equation modeling.

Table S4

Standardized Parameter Estimates from the Bifactor-ESEM Measurement Model for the Academic Motivation Scale for Upper Elementary Level

	SDT (λ)	Intrinsic (λ)	Identified (λ)	Introjected (λ)	External (λ)	Amotivation (λ)	δ
Intrinsic motivation							
Item 2	**.633****	**-.262***	.065	.026	-.078	-.032	.519
Item 9	**.683****	**-.083**	-.135*	.060	.139**	.014	.485
Item 16	**.660****	**.070**	.114	-.020	.067	.081*	.535
Item 23	**.763****	**.230**	.081	.075	-.015	.018	.352
ω		.180					
Identified motivation							
Item 3	**.522****	-.319	**.403**	.108	.204**	-.006	.410
Item 10	**.598****	-.005	**.197****	-.063	.309**	-.104**	.493
Item 17	**.606****	.221**	**.297**	.026	.344**	.019	.377
Item 24	**.656****	.253	**.336**	.086	.219**	-.090	.330
ω			.486				
Introjected motivation							
Item 7	**.331****	-.161**	.023	**.573****	.104*	.144**	.504
Item 14	**.463****	-.055	-.009	**.381****	.257**	.048	.569
Item 21	**.228****	.132	.055	**.681****	.098*	.119**	.440
Item 28	**.486****	.041	.030	**.681****	.120**	-.014	.282
ω				.749			
External motivation							
Item 1	**.255****	-.161	.354**	.074	**.498****	.005	.530
Item 8	**.569****	-.104*	.213**	.071*	**.524****	-.055	.337
Item 15	**.461****	.029	-.084	.053	**.667****	-.131**	.315
Item 22	**.200***	.201**	.139	.315**	**.626****	.034	.409
ω					.771		
Amotivation							
Item 5	**-.498****	.036	.000	.112**	.016	**.464****	.522
Item 12	**-.323****	.009	-.080	.109**	-.071	**.518****	.604
Item 19	**-.429****	.023	.005	.058	-.039	**.689****	.336
Item 26	**-.419****	-.025	-.012	.030	-.047	**.773****	.223
ω	.918					.780	

Note. *p < .05; **p < .01; ESEM: Exploratory structural equation modeling; SDT: global academic self-determination; λ: Factor loading; δ: Item uniqueness; ω: model-based omega composite reliability based on McDonald (1970); Target factor loadings are in bold.

Table S5

Standardized Parameter Estimates from the Correlated Factors CFA and ESEM Solutions for the Academic Motivation Scale for Secondary Level

	CFA		ESEM					
	Factor (λ)	δ	Intrinsic (λ)	Identified (λ)	Introjected (λ)	External (λ)	Amotivation (λ)	δ
Intrinsic motivation								
Item 2	.576**	.668	**.253****	.306**	.185**	-.248**	-.177**	.618
Item 9	.694**	.519	**.370****	.304**	.319**	-.293**	-.111*	.439
Item 16	.765**	.415	**.417****	.285**	.154**	.014	-.069	.491
Item 23	.844**	.287	**.886****	.083	.043	-.018	-.043	.095
ω	.814		.693					
Identified motivation								
Item 3	.658**	.567	.229**	**.563****	-.008	.147**	.096	.512
Item 10	.719**	.483	.278**	**.584****	-.131**	.136**	-.040	.419
Item 17	.756**	.428	.121*	**.465****	.092	.207**	-.132**	.459
Item 24	.836**	.301	.370**	**.377****	-.051	.327**	-.091	.337
ω	.832			.696				
Introjected motivation								
Item 7	.619**	.617	.031	.015	**.703****	.050	.202**	.461
Item 14	.764**	.416	.050	.011	**.532****	.119*	-.216**	.525
Item 21	.608**	.630	.187**	-.293**	**.643****	.176**	.085	.444
Item 28	.792**	.373	.093*	-.011	**.667****	.142**	.023	.415
ω	.792				.778			
External motivation								
Item 1	.630**	.603	-.221**	.404**	.049	**.461****	-.086	.542
Item 8	.837**	.300	-.160**	.363**	.187**	**.509****	-.139**	.364
Item 15	.747**	.443	-.022	.062	.200**	**.513****	-.210**	.483
Item 22	.631**	.602	.031	-.092	.170**	**.792****	.083*	.293
ω	.806					.755		
Amotivation								
Item 5	.770**	.407	-.008	.013	-.079	.064	**.773****	.411
Item 12	.723**	.478	.031	.043	.010	.094*	**.838****	.373
Item 19	.881**	.223	-.050	.065	.075	-.118**	**.864****	.224
Item 26	.829**	.312	-.108**	.028	.128**	-.170**	**.741****	.340
ω	.878						.885	

Note. *$p < .05$; **$p < .01$; CFA: Confirmatory factor analysis; ESEM: Exploratory structural equation modeling; λ: Factor loading; δ: Item uniqueness; ω: model-based omega composite reliability based on McDonald (1970); Target factor loadings are in bold.

Table S6

Standardized Parameter Estimates from the Bifactor-ESEM Measurement Model for the Academic Motivation Scale for Secondary Level

	SDT (λ)	Intrinsic (λ)	Identified (λ)	Introjected (λ)	External (λ)	Amotivation (λ)	δ
Intrinsic motivation							
Item 2	**.608****	**-.104**	.037	-.007	-.092*	-.035	.608
Item 9	**.740****	**-.071**	.010	.094*	-.113**	.061	.422
Item 16	**.779****	**.219**	-.083	-.074	.188**	.119**	.283
Item 23	**.772****	**.330****	.226**	.145**	-.083*	.011	.216
ω		.255					
Identified motivation							
Item 3	**.534****	-.082	**.467****	.039	.134**	.047	.468
Item 10	**.590****	-.005	**.476****	-.077	.117**	-.081	.399
Item 17	**.620****	-.017	**.207****	-.016	.325**	-.078	.460
Item 24	**.605****	.207**	**.463****	.079*	.256**	-.145**	.284
ω			.618				
Introjected motivation							
Item 7	**.313****	-.139**	.018	**.604****	.142**	.244**	.439
Item 14	**.502****	-.012	-.079	**.378****	.266**	-.093*	.519
Item 21	**.225****	.177**	.013	**.712****	.135**	.086*	.384
Item 28	**.432****	-.021	.042	**.578****	.224**	.078	.421
ω				.745			
External motivation							
Item 1	**.301****	-.201**	.204**	.005	**.548****	-.109*	.514
Item 8	**.416****	-.141**	.242**	.162**	**.585****	-.157**	.355
Item 15	**.395****	.108	-.043	.139**	**.611****	-.158**	.413
Item 22	**.158****	.232**	.113*	.335**	**.682****	-.004	.330
ω					.785		
Amotivation							
Item 5	**-.434****	.069	-.021	.015	-.031	**.629****	.410
Item 12	**-.356****	.100	-.020	.086*	.015	**.702****	.363
Item 19	**-.435****	-.033	-.031	.102**	-.166**	**.738****	.226
Item 26	**-.419****	-.092*	-.078	.114**	-.184**	**.650****	.340
ω	.922					.847	

Note. *p < .05; **p < .01; ESEM: Exploratory structural equation modeling; SDT: global academic self-determination; λ: Factor loading; δ: Item uniqueness; ω: model-based omega composite reliability based on McDonald (1970); Target factor loadings are in bold.

Table S7

Final Standardized Parameter Estimates from the Bifactor-ESEM Measurement Model (Latent Mean Invariance) for the Academic Motivation Scale

	SDT (λ)	Intrinsic (λ)	Identified (λ)	Introjected (λ)	External (λ)	Amotivation (λ)	δ
Intrinsic motivation							
Item 2	**.673****	**-.019**	.061	.035	-.047	-.079**	.534
Item 9	**.666****	**.208****	.045	.105**	.099**	-.043	.488
Item 16	**.596****	**.325****	.190**	.031	.160**	-.016	.476
Item 23	**.621****	**.405****	.320**	.163**	.010	-.089**	.314
ω		.336					
Identified motivation							
Item 3	**.575****	-.235**	**.408****	.070*	.176**	.010	.412
Item 10	**.527****	.062	**.399****	-.050	.247**	-.146**	.475
Item 17	**.462****	.201**	**.411****	.059*	.361**	-.107**	.433
Item 24	**.436****	.212**	**.639****	.149**	.213**	-.204**	.247
ω			.688				
Introjected motivation							
Item 7	**.336****	-.074*	.033	**.590****	.139**	.164**	.486
Item 14	**.422****	.078*	.061	**.397****	.298**	-.048	.564
Item 21	**.155****	.110**	.082*	**.692****	.153**	.095**	.446
Item 28	**.385****	.067**	.126**	**.682****	.182**	-.029	.332
ω				.753			
External motivation							
Item 1	**.282****	-.203**	.243**	.024	**.536****	-.039	.531
Item 8	**.459****	-.057	.274**	.113**	**.571****	-.139**	.352
Item 15	**.323****	.155**	.102*	.119**	**.646****	-.198**	.391
Item 22	**.043**	.119**	.238**	.338**	**.659****	-.012	.378
ω					.779		
Amotivation							
Item 5	**-.416****	-.072	-.031	.061*	-.058	**.578****	.479
Item 12	**-.295****	.000	-.021	.102**	-.090**	**.616****	.515
Item 19	**-.336****	.001	-.098**	.019	-.082**	**.770****	.278
Item 26	**-.303****	-.022	-.155**	.002	-.079**	**.765****	.292
ω	.891					.826	

Note. *$p < .05$; **$p < .01$; ESEM: Exploratory structural equation modeling; SDT: global academic self-determination; λ: Factor loading; δ: Item uniqueness; ω: model-based omega composite reliability based on McDonald (1970); Target factor loadings are in bold.

Table S8

Standardized Parameter Estimates from the CT-C(M-1) Confirmatory Factor Analytic (CFA) Model for the Interpersonal Behaviors Questionnaire

	Factor (λ)	Method factor (λ)	δ
Autonomy support (AS)			
Item 1 – mother	.617**		.620
Item 7 – mother	.799**		.362
Item 13 – mother	.818**		.331
Item 19 – mother	.776**		.398
Item 1 – father	.510**	.429**	.639
Item 7 – father	.618**	.319**	.434
Item 13 – father	.633**	.528**	.320
Item 19 – father	.618**	.420**	.442
ω	.891		
Competence support (CS)			
Item 3 – mother	.668**		.553
Item 9 – mother	.358**		.872
Item 15 – mother	.864**		.254
Item 21 – mother	.811**		.342
Item 3 – father	.487**	.361**	.633
Item 9 – father	.274**	.178**	.893
Item 15 – father	.619**	.523**	.344
Item 21 – father	.634**	.482**	.365
ω	.839		
Relatedness support (RS)			
Item 5 – mother	.694**		.518
Item 11 – mother	.617**		.620
Item 17 – mother	.834**		.305
Item 23 – mother	.783**		.386
Item 5 – father	.521**	.464**	.514
Item 11 – father	.437**	.476**	.583
Item 17 – father	.565**	.580**	.344
Item 23 – father	.521**	.537**	.441
ω	.869		
Autonomy thwarting (AT)			
Item 2 – mother	.759**		.424
Item 8 – mother	.724**		.476
Item 14 – mother	.672**		.549
Item 20 – mother	.788**		.379
Item 2 – father	.627**	-.307**	.513
Item 8 – father	.599**	-.282**	.562
Item 14 – father	.592**	-.117**	.636
Item 20 – father	.663**	-.287**	.478
ω	.880		
Competence thwarting (CT)			
Item 4 – mother	.745**		.445
Item 10 – mother	.875**		.234
Item 16 – mother	.747**		.441
Item 22 – mother	.757**		.427
Item 4 – father	.610**	-.344**	.509
Item 10 – father	.696**	-.449**	.313
Item 16 – father	.623**	-.317**	.512
Item 22 – father	.647**	-.303**	.489
ω	.906		
Relatedness thwarting (RT)			
Item 6 – mother	.692**		.521
Item 12 – mother	.746**		.444
Item 18 – mother	.837**		.299
Item 24 – mother	.774**		.402
Item 6 – father	.516**	-.396**	.577
Item 12 – father	.536**	-.418**	.537
Item 18 – father	.660**	-.406**	.400
Item 24 – father	.553**	-.416**	.521
ω	.884	.879	

Note. $^*p < .05$; $^{**}p < .01$; CT-C(M-1): Correlated trait correlated method minus one model; λ: Factor loading; δ: Item uniqueness; ω: model-based omega composite reliability based on McDonald (1970).

Table S9

Standardized Parameter Estimates from the CT-C(M-1) Exploratory Structural Equation Modeling (ESEM) Model for the Interpersonal Behaviors Questionnaire

	AS (λ)	CS (λ)	RS (λ)	AT (λ)	CT (λ)	RT (λ)	MF (λ)	δ
Autonomy support (AS)								
Item 1 – mother	**.659****	-.066	-.021	-.264**	.091*	.062		.509
Item 7 – mother	**.815****	-.025	.004	.039	-.126**	-.002		.284
Item 13 – mother	**.628****	.085*	.083*	.079*	-.140**	-.091**		.360
Item 19 – mother	**.509****	.251**	.007	-.214**	.194**	-.132**		.388
Item 1 – father	**.552****	-.094*	-.021	-.251**	-.015	.173**	.418**	.496
Item 7 – father	**.679****	-.043	.067	.028	-.141**	.139**	.373**	.328
Item 13 – father	**.570****	.052	.096**	.075*	-.100**	.027	.521**	.295
Item 19 – father	**.395****	.203**	.109**	-.148**	.088*	.035	.453**	.433
ω	.882							
Competence support (CS)								
Item 3 – mother	.234**	**.464****	.137**	.151**	-.037	-.047		.518
Item 9 – mother	.071	**.369****	.190**	.048	.045	.111*		.797
Item 15 – mother	.120**	**.583****	.176**	-.048	-.194**	.044		.318
Item 21 – mother	.017	**.743****	-.089*	-.039	-.099*	-.159**		.249
Item 3 – father	.127**	**.369****	.212**	.159**	-.026	-.012	.329**	.579
Item 9 – father	.037	**.269****	.330**	.098*	.069	.088	.103**	.775
Item 15 – father	.057	**.491****	.243**	.040	-.231**	.189**	.477**	.309
Item 21 – father	.007	**.622****	-.009	.141**	-.221**	-.026	.526**	.240
ω		.802						
Relatedness support (RS)								
Item 5 – mother	.210**	.293**	**.449****	-.071	.023	.074		.466
Item 11 – mother	.161**	.212**	**.432****	-.144**	.139**	-.038		.579
Item 17 – mother	.241**	.196**	**.201****	-.057	.061	-.435**		.363
Item 23 – mother	.219**	.267**	**.179****	.067	.092	-.475**		.351
Item 5 – father	.122**	.141**	**.505****	.008	-.089*	.067	.348**	.449
Item 11 – father	-.033	.078*	**.669****	-.137**	.134**	-.021	.370**	.417
Item 17 – father	.089*	.068	**.409****	.027	.012	-.263**	.545**	.331
Item 23 – father	.068	.063	**.411****	.105**	.076	-.366**	.501**	.348
ω			.762					
Autonomy thwarting (AT)								
Item 2 – mother	-.135**	.127**	-.151**	**.525****	.225**	.043		.429
Item 8 – mother	-.096*	.085*	-.142**	**.526****	.208**	.031		.475
Item 14 – mother	-.100**	.090*	-.052	**.671****	-.023	.118**		.457
Item 20 – mother	-.239**	-.044	.146**	**.518****	-.006	.263**		.376
Item 2 – father	-.015	.013	-.071	**.505****	.234**	-.061	-.327**	.474
Item 8 – father	-.032	.054	-.086*	**.530****	.222**	-.103*	-.310**	.480
Item 14 – father	-.072	.077	.036	**.681****	-.003	-.005	-.230**	.470
Item 20 – father	-.187**	.028	.110**	**.462****	.094*	.107*	-.368**	.454
ω				.844				
Competence thwarting (CT)								
Item 4 – mother	-.235**	.006	.069	.039	**.546****	.203**		.402
Item 10 – mother	-.152**	-.144**	-.008	.070	**.622****	.157**		.214
Item 16 – mother	.033	-.309**	.177**	.329**	**.302****	.236**		.370
Item 22 – mother	-.014	-.332**	.062	.327**	**.235****	.157**		.435
Item 4 – father	-.154**	.074	.076*	.004	**.650****	.104*	-.323**	.375
Item 10 – father	-.052	-.144**	.021	.006	**.683****	.050	-.404**	.226
Item 16 – father	.098*	-.258**	.138**	.291**	**.358****	.097*	-.404**	.404
Item 22 – father	.073	-.234**	.022	.337**	**.289****	.077	-.355**	.457
ω					.825			
Relatedness thwarting (RT)								
Item 6 – mother	-.060	.062	-.339**	.118**	.258**	**.275****		.523
Item 12 – mother	.029	-.046	-.295**	.209**	.160**	**.381****		.474
Item 18 – mother	-.104**	-.100*	.012	.080*	.043	**.750****		.189
Item 24 – mother	-.016	-.118**	.000	.082	.123**	**.655****		.335
Item 6 – father	-.016	.118*	-.333**	.058	.287**	**.213****	-.320**	.547
Item 12 – father	.145**	.040	-.335**	.186**	.161**	**.322****	-.398**	.490
Item 18 – father	-.036	-.023	-.030	.002	.113*	**.633****	-.470**	.266
Item 24 – father	.059	.057	-.130**	-.037	.176**	**.586****	-.440**	.393
ω						.819	.896	

Note. **p* < .05; ***p* < .01; MF: method factor (reflecting inter-parent inconsistencies); CT-C(M-1): Correlated trait correlated method minus one model; λ: Factor loading; δ: Item uniqueness; ω: model-based omega composite reliability based on McDonald (1970). Target loadings are bold.

Table S10

Latent Factor Correlations from the CT-C(M-1) CFA (below the diagonal) and ESEM (above the diagonal) Solutions for the Interpersonal Behaviors Questionnaire

	AS	CS	RS	AT	CT	RT	MF
Autonomy support (AS)	—	.538**	.428**	-.392**	-.409**	-.372**	0
Competence support (CS)	.756**	—	.325**	-.237**	-.294**	-.495**	0
Relatedness support (RS)	.767**	.865**	—	-.059	-.321**	-.212**	0
Autonomy thwarting (AT)	-.658**	-.406**	-.471**	—	.476**	.339**	0
Competence thwarting (CT)	-.678**	-.720**	-.595**	.848**	—	.327**	0
Relatedness thwarting (RT)	-.632**	-.679**	-.824**	.680**	.826**	—	0
Method factor (MF)	0	0	0	0	0	0	—

Note. **p* < .05; ***p* < .01; MF: method factor (reflecting inter-parent inconsistencies); CT-C(M-1): Correlated trait correlated method minus one model; CFA: Confirmatory factor analysis; ESEM: Exploratory structural equation modeling.

Table S11

Standardized Parameter Estimates from the CT-C(M-1) Bifactor Exploratory Structural Equation Modeling (B-ESEM) Model for the Interpersonal Behaviors Questionnaire

	SUP (λ)	AS (λ)	CS (λ)	RS (λ)	AT (λ)	CT (λ)	RT (λ)	MF (λ)	δ
Autonomy support (AS)									
Item 1 – mother	**.507****	**.372****	-.123**	-.166**	-.152**	.106**	.160**		.502
Item 7 – mother	**.687****	**.400****	-.116**	-.151**	.118**	.003	.176**		.287
Item 13 – mother	**.710****	**.285****	-.040	-.101	.180**	.008	.083*		.364
Item 19 – mother	**.672****	**.209****	.083*	-.226**	-.026	.241**	.024		.387
Item 1 – father	**.439****	**.469****	.049	.153**	-.280**	-.044	.017	-.052	.466
Item 7 – father	**.572****	**.536****	.084**	.232**	-.030	-.104**	.022	-.120	.309
Item 13 – father	**.593****	**.495****	.140**	.230**	.004	-.099**	-.038	.162	.293
Item 19 – father	**.565****	**.359****	.204**	.140**	-.128**	.043	-.010	.205*	.431
ω		.763							
Competence support (CS)									
Item 3 – mother	**.574****	.034	**.239****	-.051	.293**	.092*	.077		.509
Item 9 – mother	**.305****	.006	**.222****	.062	.160**	.127**	.117**		.798
Item 15 – mother	**.737****	-.030	**.293****	-.050	.125**	-.012	.120**		.338
Item 21 – mother	**.682****	-.121**	**.424****	-.279**	.110**	.035	-.062		.245
Item 3 – father	**.451****	.134**	**.290****	.193**	.176**	.013	-.016	.219**	.578
Item 9 – father	**.267****	.021	**.149****	.186**	.193**	.118**	.134**	.178**	.771
Item 15 – father	**.585****	.147**	**.390****	.294**	.041	-.173**	.091*	.228*	.305
Item 21 – father	**.558****	.135**	**.515****	.108	.068*	-.196**	-.127**	.300**	.244
ω			.627						
Relatedness support (RS)									
Item 5 – mother	**.648****	-.023	.049	**.154**	.188**	.166**	.252**		.428
Item 11 – mother	**.578****	-.041	.011	**.131**	.117**	.235**	.138**		.559
Item 17 – mother	**.735****	-.016	.038	**-.077**	.133**	.188**	-.205**		.358
Item 23 – mother	**.696****	-.045	.080*	**-.103**	.259**	.212**	-.217**		.337
Item 5 – father	**.550****	.114**	.098**	**.433****	.094*	-.010	.077	.150	.450
Item 11 – father	**.480****	.014	.020	**.496****	.015	.141**	.061	.315**	.399
Item 17 – father	**.563****	.148**	.099**	**.382****	.041	.002	-.207**	.367**	.326
Item 23 – father	**.516****	.118**	.102**	**.359****	.117**	.067	-.280**	.370**	.347
ω				.587					
Autonomy thwarting (AT)									
Item 2 – mother	**-.585****	.019	.246**	.059	**.356****	.143**	-.100**		.437
Item 8 – mother	**-.574****	.079*	.248**	.081	**.336****	.131**	-.148**		.445
Item 14 – mother	**-.506****	.054	.217**	.173**	**.467****	-.021	-.042		.444
Item 20 – mother	**-.601****	-.027	.093*	.342**	**.362****	-.024	.096*		.372
Item 2 – father	**-.490****	-.066	-.034	-.165**	**.468****	.217**	.070	.131	.439
Item 8 – father	**-.460****	-.079	.004	-.174**	**.487****	.209**	.026	.129	.454
Item 14 – father	**-.395****	-.079**	.070*	.034	**.593****	.072*	.034	.021	.473
Item 20 – father	**-.490****	-.191**	-.011	.035	**.465****	.154**	.143**	-.084	.454
ω					.780				
Competence thwarting (CT)									
Item 4 – mother	**-.664****	.037	.187**	.204**	-.018	**.360****	-.034		.351
Item 10 – mother	**-.783****	.094**	.083**	.161**	-.009	**.377****	-.059		.199
Item 16 – mother	**-.626****	.153**	-.094**	.324**	.229**	**.192****	.113*		.369
Item 22 – mother	**-.646****	.094**	-.126**	.230**	.204**	**.119***	.072		.444
Item 4 – father	**-.548****	-.119**	.036	-.086	.119**	**.527****	.123**	.022	.369
Item 10 – father	**-.647****	-.075*	-.118**	-.130*	.107**	**.543****	.098*	-.053	.226
Item 16 – father	**-.513****	-.011	-.188**	.056	.345**	**.364****	.132**	-.223**	.380
Item 22 – father	**-.561****	.002	-.174**	-.025	.329**	**.262****	.129**	-.087	.454
ω						.729			
Relatedness thwarting (RT)									
Item 6 – mother	**-.625****	.098**	.163**	-.107	-.021	.089*	**.081**		.546
Item 12 – mother	**-.660****	.157**	.073	-.043	.047	.009	**.200****		.490
Item 18 – mother	**-.716****	.133**	.029	.257**	-.052	-.077	**.461****		.180
Item 24 – mother	**-.654****	.160**	.013	.216**	-.032	.004	**.410****		.330
Item 6 – father	**-.530****	-.008	.077	-.339**	.035	.191**	**.178****	-.029	.528
Item 12 – father	**-.525****	.069	.009	-.313**	.150**	.119**	**.284****	-.154	.481
Item 18 – father	**-.585****	-.058	-.057	-.029	.056	.123**	**.500****	-.346**	.262
Item 24 – father	**-.501****	.007	.008	-.130*	.021	.164**	**.463****	-.327**	.384
ω	.975						.675	.650	

Note. **p* < .05; ***p* < .01; CT-C(M-1): Correlated trait correlated method minus one model; SUP: global need support; MF: method factor (reflecting inter-parent inconsistencies); λ: Factor loading; δ: Item uniqueness; ω: model-based omega composite reliability based on McDonald (1970). Target loadings are bold.

Table S12

Correlations Between the Variables Used in This Study

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Global SDT	—														
2. Intrinsic	0	—													
3. Identified	0	0	—												
4. Introjected	0	0	0	—											
5. External	0	0	0	0	—										
6. Amotivation	0	0	0	0	0	—									
7. Global need support	.231**	-.029	.141**	.078**	.092**	-.080**	—								
8. Autonomy support	.110**	-.043	.078**	.060*	-.015	.040	0	—							
9. Competence support	.059*	.020	.079**	.035	.124**	-.006	0	0	—						
10. Relatedness support	.063*	.031	.044	.097**	-.004	.117**	0	0	0	—					
11. Autonomy thwarting	.064*	.029	.012	.166**	.113**	.052	0	0	0	0	—				
12. Competence thwarting	.047	.016	.031	.123**	.030	.197**	0	0	0	0	0	—			
13. Relatedness thwarting	.049	-.080**	.017	.066	.040	.083**	0	0	0	0	0	0	—		
14. Inter-parent inconsistency	.080**	.087**	.002	.040	-.017	.062*	0	0	0	0	0	0		—	
15. Achievement	.103**	-.067**	.114**	-.086**	.106**	-.023	.158**	.013	.069*	.060*	-.006	-.082**	-.016	.105**	—
16. Expectations	.154**	-.080**	.113**	-.020	.167**	-.098**	.198**	.029	.106**	-.050	-.024	-.069*	.025	.026	.545**

Note. *p < .05, **p < .01; Variables (with the exception of achievement and expectations) are factor scores estimated in standardized units (M = 0, SD = 1); SDT: self-determined motivation.

Table S13

Exact Within-Profile Means, Variances and 95% Confidence Intervals [95% CI] from the Final Four-Profile Solution (Distributional Similarity)

	Profile 1 Mean [95% CI]	Profile 2 Mean [95% CI]	Profile 3 Mean [95% CI]	Profile 4 Mean [95% CI]	Profiles 1 to 4 Variances [95% CI]
Global SDT	-.524 [-.692, -.357]	.091 [-.095, .277]	-.195 [-.323, -.066]	.369 [.228, .510]	.571 [.510, .632]
Intrinsic	-.219 [-.359, -.079]	.057 [-.078, .192]	-.004 [-.097, .088]	.074 [.002, .147]	.396 [.362, .430]
Identified	-.783 [-1.132, -.434]	.288 [.154, .423]	.033 [-.076, .143]	.182 [.076, .288]	.323 [.280, .365]
Introjected	-.171 [-.374, .032]	-.905 [-1.178, -.631]	.079 [-.004, .163]	.440 [.286, .594]	.440 [.388, .492]
External	-.330 [-.527, -.134]	-.104 [-.296, .088]	-.060 [-.167, .048]	.186 [.081, .291]	.520 [.478, .562]
Amotivation	-.156 [-.358, .045]	-.572 [-.692, -.451]	.859 [.721, .997]	-.345 [-.445, -.244]	.292 [.241, .343]

Note. SDT: Self-determined motivation; CI: Confidence interval; Factors were estimated from factor scores with a mean of 0 and a standard deviation of 1; Profile 1: Non-Motivated; Profile 2: Self-Determined/Identified; Profile 3: Amotivated; Profile 4: Highly Motivated.

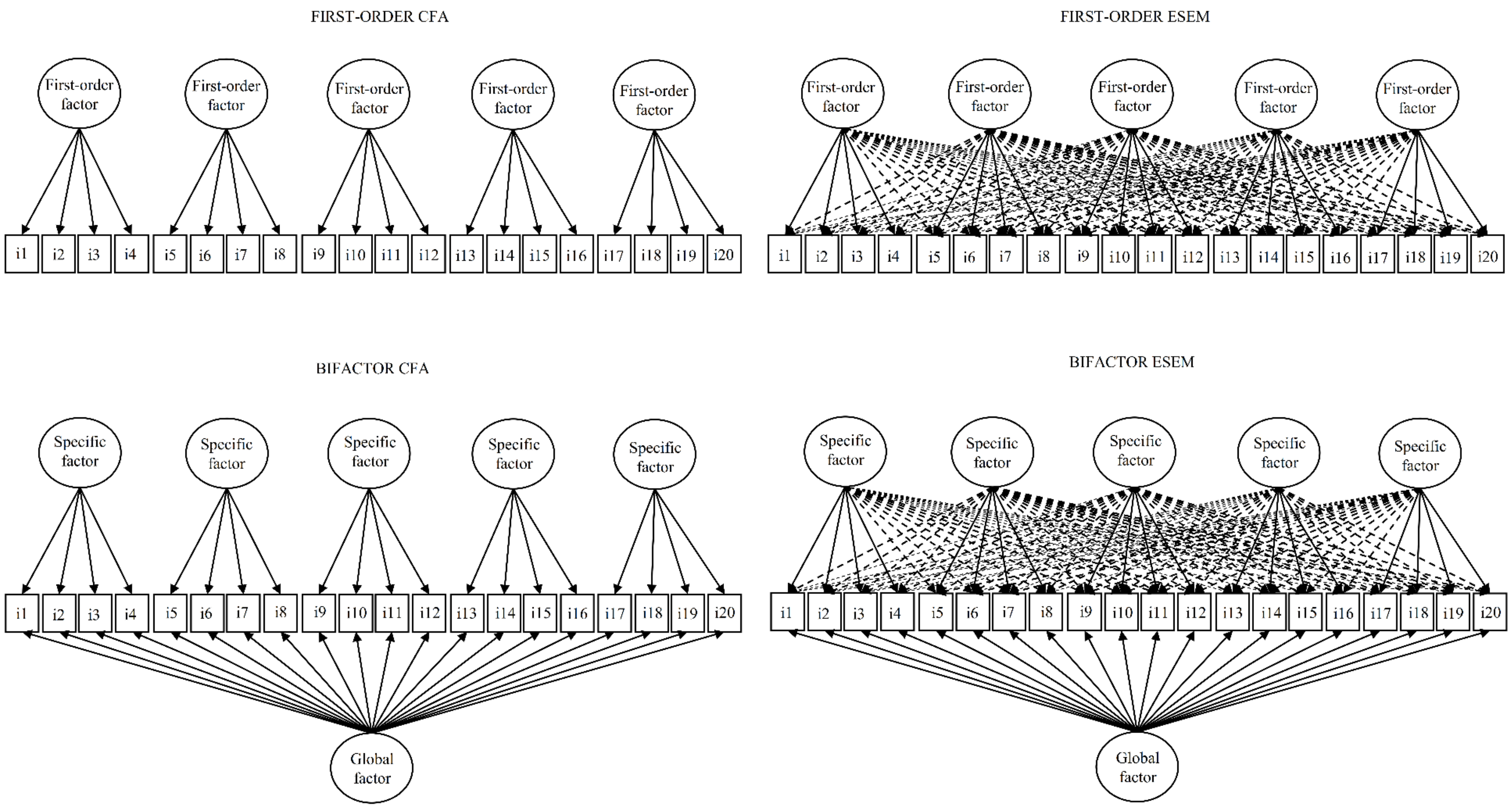

Figure S1

Schematic Illustration of the Estimated Measurement Models

Note. CFA: confirmatory factor analysis; ESEM: exploratory structural equation modeling. Ovals indicate latent variables. Directional arrows represent target factor loadings, directional dashed arrows represent cross-loadings. i1-i20 represent questionnaire items. Factor correlations are freely estimated in the first-order models but now shown for the sake of simplicity, while no factor correlations are estimated in the bifactor models.

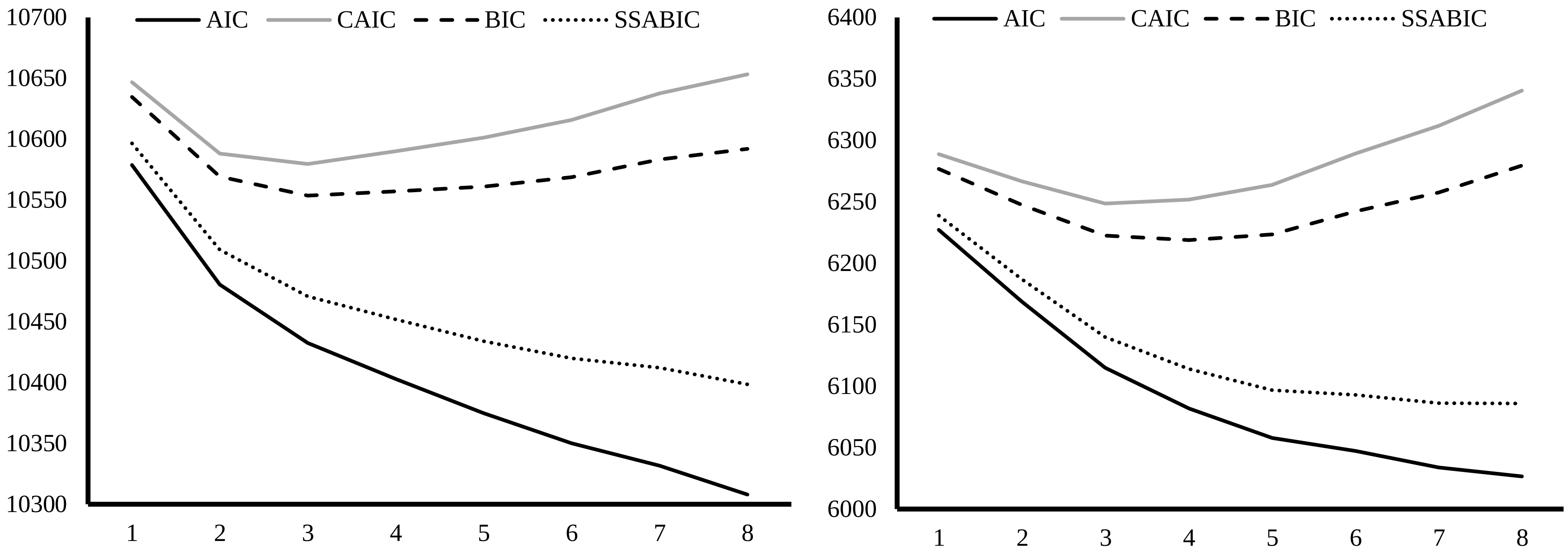

Figure S2

Elbow Plots for the Information Criteria Used in Class Enumeration for Upper Elementary (Left) and Secondary (Right) Levels

Note. AIC: Akaike Information Criterion; BIC: Bayesian Information Criterion; CAIC: Consistent AIC; SSABIC: Sample-Size-Adjusted BIC.