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Academic motivation of intellectually gifted students and their classmates in regular primary school classes: A multidimensional, longitudinal, person- and variable-centered approach

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ABSTRACT

Most prior studies on academic motivation of intellectually gifted children focused only on intrinsic motivation. To gain insight into the full scope of intellectually gifted students' motivation, differences between clinically diagnosed gifted students and their classmates in multiple motivational dimensions (intrinsic, identified, introjected, and external regulation, and amotivation) were examined across two school years. Using both variable-centered and person-centered techniques, we examined differences in separate motivational dimensions as well as differences in configurations of motivational dimensions ('profiles'). A sample of 1438 primary school students in Grade 3–5 (5.5% clinically diagnosed as gifted with an IQ > 120) participated. They filled out motivation questionnaires pertaining to their regular class during two waves across two school years. Gifted students reported more favourable motivation at Wave 1 but lost this advantage over time. Specifically, they demonstrated more intrinsic motivation at Wave 1, but a decrease in identified regulation, and a stronger increase in external regulation and amotivation from Wave 1 to Wave 2. Similarly, gifted students were more likely to transition from theoretically more favourable to less favourable profiles. These findings suggest that children who are clinically diagnosed as gifted are at risk for developing unfavourable motivational patterns toward the end of primary school.

Educational relevance statement: Motivation for school plays a pivotal role in students' school engagement and achievement. This is also the case for intellectually gifted children. Just like other children, motivation enables them to translate their abilities into achievement. Intellectually gifted students in primary school may particularly be at risk of unfavourable motivational developments because it can be difficult for regular schools to provide an optimally challenging learning environment for them. This study aimed to get a full understanding of the motivational dynamics of intellectually gifted children in regular classes. This would be a step toward developing more targeted interventions that can address motivational problems encountered by gifted students in regular classes.

The findings of this study indicated that, clinically diagnosed gifted children initially reported more favourable motivation, but lost this advantage over time. Toward the end of primary education, they were more likely than other children to show a decrease in external motivation and amotivation.

These findings are of great practical importance. If teachers can identify students who start to become less motivated for school, it may be easier to intervene and prevent motivational problems and subsequent underachievement later on. To identify students who are at risk of developing an unfavourable motivational pattern, teachers or other educational professionals could regularly assess their students' motivation or engage in talks with their students about their motivation. Additionally, prior research suggests teaching practices and

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interventions which support students' need for autonomy, structure, and relatedness are likely to foster students' motivation for school, for gifted students as well as other students.

1. Introduction

Motivation for school plays a pivotal role in students' school engagement and achievement (Howard et al., 2020). This is of course also the case for intellectually gifted children. In this study, we considered children who were clinically tested and scored an IQ > 120 to be intellectually gifted (Gagné, 2004, 2020). Just like other children, motivation enables intellectually gifted children to translate their abilities into achievement (McCoach & Flake, 2018). Indeed, low motivation has been found to be an important predictor of underachievement among intellectually gifted students (Ramos et al., 2022). For many students, motivation starts to decline during primary school (Scherrer & Preckel, 2019). Intellectually gifted students may particularly be at risk of such unfavourable motivational developments because it can be challenging for regular schools to provide an optimal learning environment for them. In most regular schools, curricula are attuned to students with average intellectual capacities and motivation (Neihart et al., 2015). Also, teachers often aim their instruction at the average classroom level and dedicate most of their time and effort to supporting the weaker students in class (Deunk et al., 2018). Even when it is known that a students has above-average cognitive abilities (i.e., when a student is diagnosed as gifted), regular mixed-ability class teachers still face challenges in providing an optimally challenging learning environment for these students. This difficulty arises from the inherent variation in learning needs within mixed-ability classes (Reis & Renzulli, 2010). As such, intellectually gifted children can feel underchallenged in regular mixed-ability classes (Feuchter & Preckel, 2021), which can adversely affect their motivation for school (Lavrijsen et al., 2021). While enriched pull-out classes are often offered as a countermeasure, it remains unclear whether this measure alone is sufficient to maintain their motivation for the regular curriculum in their mixed-ability classes (Hornstra et al., 2022).

Despite these commonly voiced concerns that intellectually gifted students are at risk of developing unfavourable motivational patterns in regular school classes, prior studies on gifted students' motivation have mostly shown that intellectually gifted students typically report *higher* levels of motivation for school than their classmates (Gottfried & Gottfried, 1996; Wirthwein et al., 2019). However, these studies only focused on intellectually gifted students' intrinsic motivation, even though there is widespread consensus that motivation is a multidimensional construct (Hayenga & Henderlong Corpus, 2014; Ryan & Deci, 2020). That is, multiple motivational dimensions can underlie students' engagement in school. These can include intrinsic motivation such as interest and enjoyment as well as more extrinsic motivations. Aligning with Self Determination Theory (SDT) (Ryan & Deci, 2020), which defines motivation as a multifaceted construct, the present study focused on intrinsic and multiple extrinsic types of motivation as well as amotivation (i.e., a lack of motivation) to gain a better insight into the multifaceted nature of intellectually gifted students' motivation in their regular class. Accordingly, using a variable-centered approach, the first aim of the present study was to examine differences between intellectually gifted students, who were diagnosed by a clinician as having an IQ > 120, and other students in these motivational dimensions. This provides insights into the extent to which clinically diagnosed gifted students are more prone than other students to be motivated for their schoolwork for intrinsic reasons (for example, interest in the subject matter), but also whether they are more likely to endorse extrinsic reasons (for example, wanting to get a high grade), or to be amotivated. We also took into account age-related differences in motivation between intellectually gifted students and their classmates. As such, we aimed to contribute to prior research, which has mostly been cross-sectional.

In addition, students may be characterized by combinations of different motivational dimensions and based on these combinations, it may be possible to distinguish different subgroups of students. Some students may for example be primarily intrinsically motivated while others may endorse both intrinsic and extrinsic motivations (e.g., Vansteenkiste et al., 2009. Studying such combinations is insightful as the potential effects of specific motivational dimensions may depend on the co-occurrence of the dimensions. That is, external motivation may be particularly harmful when it occurs without intrinsic motivation, but less so when combined with high levels of intrinsic motivation (e.g., Vansteenkiste et al., 2009). By additionally adopting a person-centered approach, the present study aimed to examine whether specific combinations of motivational dimensions (i.e., profiles) are more commonly observed among intellectually gifted students than among their classmates. The combination of both variable- and person-centered approaches can yield more insights into both *quantitative* differences between clinically diagnosed gifted students and their classmates in the separate motivational dimensions (i.e., mean-level differences) as well as *qualitative* differences with regards to the combinations of motivations they endorse.

The present study focused on clinically diagnosed gifted students in the upper grades of primary school (Grade 3 to 5 at Wave 1) who attended regular mixed-ability classrooms, as this is the period in which students start to be at risk of declining academic motivation (Scherrer & Preckel, 2019). In all, this study aimed to contribute to a broader and better understanding of the motivational dynamics of intellectually gifted students in their regular class. This could be a step toward developing more targeted interventions that can address motivational problems that are potentially encountered by these children in regular classes.

1.1. Intellectually gifted children

In the present study, we considered children who were identified by a clinician as having an IQ above 120 to be intellectually gifted. IQ testing for these children is typically done when there is a strong suspicion that a child is cognitively ahead of their peers and/or in case of a potential mismatch between a child's educational needs and their school environment (Hertzog et al., 2018). The threshold of 120, which we adopt in our definition of intellectual giftedness, corresponds with an above-average IQ (Gagné, 2004, 2020) and is used as a threshold in various other studies as well (see for example, Bergold et al., 2015; Gilar-Corbi et al., 2019; Guignard et al., 2016; Ramos et al., 2022; Wirthwein et al., 2019). In research and practice, there is considerable variation in the definition of giftedness (Pfeiffer et al., 2018; Carman, 2013; Pfeiffer et al., 2018; Sternberg & Ambrose, 2021). Classic definitions assume high scores on a general intelligence factor (g-factor) (Terman, 1925 as cited in Dai, 2018), while more recent definitions tend to be multidimensional in nature (e.g., Renzulli & Reis, 2018; Sternberg, 2018) or focus on talent development rather than on stable dispositions (Gagné, 2020; Worrell et al., 2019). Despite the broadening of the concept, general intelligence remains an important criterion for giftedness, in part because it explains common variance between different talent components and predicts talent development across time (Worrell et al., 2019). As such, intelligence is one of the most studied and best understood constructs in psychology (Robinson, 2005; Warne, 2016). It can predict long-term outcomes in many life domains (e.g., Spengler et al., 2015; Vazsonyi et al., 2022) and knowledge on children's intelligence can provide insights with regard to suitable educational interventions. Moreover, there are many validated, reliable ways to assess intelligence (Robinson, 2005; Warne, 2016). Therefore and to follow-up on Carman's

(2013) suggestion to ensure a more homogeneous group of participants, we focused on intelligence as main component of intellectual giftedness.

1.2. Dimensions of motivation

Within SDT, motivation is described on a continuum based on the degree to which the reasons underlying behaviours are self-determined (Howard et al., 2021). The most self-determined type of motivation is intrinsic motivation. Intrinsic motivation occurs when an activity is pursued because it is inherently satisfying or interesting (Ryan & Deci, 2020). Contrarily, students are extrinsically motivated when an activity is undertaken for external reasons (Ryan & Deci, 2020; Vallerand et al., 1992). Four types of extrinsic motivation – integrated regulation, identified regulation, introjected regulation, and external regulation – can be distinguished from one another based on the degree of self-determination (Deci & Ryan, 1985; Deci et al., 1996; Ryan & Connell, 1989). A student with integrated regulation internalizes the reasons for an action, so these reasons become congruent with other values and needs. It is the most self-determined type of extrinsic motivation and therefore situated next to intrinsic motivation on the continuum. Next on the continuum is identified regulation. Students with identified motivation find the results of an activity to be valuable to themselves, even though they may find the activity in itself not intrinsically motivating. Integrated and identified regulation are both characterized by a high degree of autonomy. Therefore, these forms of motivation, along with intrinsic motivation, are often considered forms of *autonomous motivation* (Vansteenkiste et al., 2006). Introjected and external regulation, in contrast, are considered to be types of *controlled motivation* as both types of regulation are characterized by experiencing a sense of pressure (Gagné & Deci, 2005; Ryan & Deci, 2002). In case of introjected regulation, the pressure comes from within the individual, for example when an activity is performed out of feelings of guilt, pride, or fear of failure. External regulation is the least self-determined form of extrinsic motivation and occurs for example when students perform an activity to get an external reward or to avoid punishment.

Finally, amotivation refers to a lack of motivation or the absence of any intentionality toward action. On the continuum of self-determination it is placed at the opposite end from intrinsic motivation and adjacent to external regulation (Howard et al., 2021). Amotivation occurs when students see little reason to invest effort into their schoolwork and this can lead to disengagement in class (Legault et al., 2006) as well as underachievement (Rubenstein et al., 2012). In Section 1.4, we discuss the interplay between amotivation and the other motivational dimensions.

1.3. (Development in) motivation of intellectually gifted students

Studies among general school populations have shown that many students experience a decrease in their intrinsic motivation as they grow older (e.g., Corpus et al., 2009; Opdenakker et al., 2012), and this decrease typically has its onset in late primary school (Scherrer & Preckel, 2019). Among other reasons, this might be due to a poor fit between the school environment and the educational needs and developmental stage of students (Eccles, 2004). This may particularly apply to intellectually gifted students in regular mixed-ability classes as prior research suggested that it is difficult to meet the needs of these students in regular classes and this mismatch is argued to increase as they grow older (Reis & Renzulli, 2010). This may explain why intellectually gifted students have been found to experience less challenge than other students in regular classrooms (Lavrijsen et al., 2021) and why intellectually gifted students report more favourable motivation in a specialized pull-out class than in their regular class (Hornstra et al., 2022). Hence, intellectually gifted students in regular classes may be even more prone than other students to unfavourable motivational developments.

While longitudinal research is scarce (for an exception, see Gottfried and Gottfried, 1996), several cross-sectional studies among upper primary school students have examined mean-level differences in intrinsic motivation between intellectually gifted students and other students. Vallerand et al. (1994) found that students in fulltime gifted classes with an IQ $\geq$ 130 reported more intrinsic motivation than mixed-ability students in regular primary school classes. Wirthwein et al. (2019) found that high school gymnasium students (i.e., students in the highest track) with an IQ $>$ 120 reported more interest in math and higher achievement motivation (i.e., to feel motivated by demanding, challenging tasks) compared to a matched control group of their classmates with IQs $\leq$ 120. These studies focused on intellectually gifted students in high-ability settings. Other studies suggest that gifted students in mixed-ability classes also report higher intrinsic motivation than other students. That is, Gottfried and Gottfried, 1996 found that gifted students with an IQ $\geq$ 130 in regular mixed-ability classes reported more intrinsic motivation than their classmates. Also the findings by Davis and Connell (1985), who compared gifted students (IQ $>$ 125) and their classmates in mixed-ability classes and Bergold et al. (2020) who compared gifted students with an IQ $>$ 130 with a matched control group of average-ability students, suggested higher intrinsic motivation among intellectually gifted students.

Research on controlled motivation of intellectually gifted students is more scarce. Two cross-sectional studies examined differences between intellectually gifted students and other students in controlled types of motivation. Meier et al. (2014) compared Grade 5 students in special gifted classes with students in regular classes. Both groups reported similar levels of performance goals (e.g., wanting to outperform others), which can be considered a controlled type of motivation (Vansteenkiste et al., 2014). Preckel et al. (2008) reported comparable findings among a sample of Grade 6 students in mixed-ability classes: students in the top 5% on a non-verbal reasoning test did not differ from their classmates in the extent to which they endorsed performance goals.

To our knowledge, no peer-reviewed papers have been published that examined amotivation differences between intellectually gifted and other students. Given that amotivation and intrinsic motivation are situated at the opposite end of the self-determination continuum (Howard et al., 2020; Ryan & Deci, 2020), high levels of both intrinsic motivation and amotivation are unlikely to coincide. Hence, one might assume that higher levels of intrinsic motivation that are often found among intellectually gifted students coincide with lower levels of amotivation.

1.4. Motivational profiles

As the previous section shows, students can differ from one another in the quantity of their motivation (mean-level differences). However, SDT posits that the quality of students' motivation is more important to consider than the mere quantity. Different types of motivation can co-occur in different combinations and these combinations differ in terms of motivational quality. Students can predominantly endorse either autonomous or controlled motives, but they can also endorse high levels or low levels of both types of motivation (Vansteenkiste et al., 2009). For example, a student might enjoy an activity but also feel pressure to succeed.

Person-centered analyses (Magnusson, 1998) can be used to identify subgroups of students who display different combinations (i.e., profiles) of motivations. A few studies have adopted such an approach to examine motivational profiles among general school populations. Although many different profiles are theoretically possible, these analyses typically identify around 3 to 8 profiles. Vansteenkiste et al. (2009), for example, distinguished four different motivational profiles among high school students and college students: a high-quality motivation profile in which students reported high-autonomous and low controlled motivation; a low-quality profile with low autonomous and high controlled motivation; a low-quantity profile with low autonomous and controlled motivation; and a high-quantity profile with high autonomous and high controlled motivation. Out of the four groups, the students in the high-quality profile displayed the most optimal outcomes in terms of self-regulated learning and achievement. Likewise, Hayenga and Henderlong Corpus (2014) identified four similar profiles among a sample of middle school students and found the highest GPA scores among students in the high-quality profile. Wormington et al. (2012) also obtained four similar profiles among high-school students and found these to be associated with academic performance and extracurricular participation in similar ways. In a study among primary school students, Corpus and Wormington (2014) identified three groups of students, which resembled a high-quantity profile, a high-quality profile, and a low-quality profile.

The aforementioned studies did not include amotivation. Amotivation refers to a lack of motivation and the presence of amotivation therefore seems to suggest an absence of any other type of motivation and vice versa (Vallerand et al., 1992). However, various studies show that the relations between amotivation and other types of motivation are not completely oppositional when amotivation and other motivations are assessed at a rather general level (i.e., students' general motivation for school). That is, correlations between these different types of motivation obtained in previous research suggest that amotivation and autonomous motivation are moderately negatively associated, and correlations between amotivation and controlled types of motivation were moderately positive as well as weakly negative (Boiché et al., 2008; Gillet et al., 2012; Hornstra et al., 2020; Ratelle et al., 2007; Taylor et al., 2014). This could be because one can be autonomously motivated for some tasks in schools and be amotivated for others tasks, or be motivated on some days and not others. Hence, when looking at school-general motivation, amotivation could coincide with other motivations. Still, even at this level, it is unlikely that high amotivation coincides with high autonomous or high controlled motivation. This is especially the case for autonomous motivation because autonomous motivations and amotivation are situated on the opposite ends of the self-determination continuum. Controlled motivations on the other hand, are situated adjacent to amotivation on the continuum as controlled motivation and amotivation both represent a lack of self-determination (Howard et al., 2020).

Only a few empirical person-centered studies among high school and college students included amotivation alongside autonomous and controlled types of motivation (Boiché et al., 2008; Meens et al., 2018; Ratelle et al., 2007). The findings of these studies suggested that autonomous motivation and amotivation indeed act as opposites as these studies distinguished profiles with high autonomous motivation and low amotivation and vice versa in addition to profiles with moderate levels of autonomous motivation and amotivation. Combinations with relatively high amotivation and relatively high levels of controlled motivation were also identified. Hence, when identifying motivational profiles, amotivation will likely be associated with low levels of autonomous motivation, but may occur alongside moderate levels of controlled motivation as both refer to a lack of self-determination (e.g., a student may be rather uninterested in their school work, yet simultaneously experience some external pressure: "I don't think this is important or useful, but I have to do it anyways").

1.5. The present study

To gain more insight into the multidimensional and dynamic nature of intellectually gifted students' motivation, a two-year two-wave study was conducted among clinically diagnosed gifted children and their classmates in regular classes in the upper grades of primary school (Grade 3 to 6). First, this study sought to compare mean levels of motivation of intellectually gifted students and their mixed-ability classmates concerning their motivation in their regular class. Thereto, the present study included the full motivational spectrum including intrinsic, identified, introjected, and external regulated motivation, as well as amotivation. In line with findings from prior studies (Bergold et al., 2020; Gottfried and Gottfried, 1996; Vallerand et al., 1994; Wirthwein et al., 2019), we hypothesised that gifted students would display higher mean levels of autonomous types of motivation (i.e., intrinsic and identified regulation) than their classmates (H1a) and similar levels of controlled motivation (i.e., introjected and external regulation; cf., Meier et al., 2014; Preckel et al., 2008) (H1b). Given the theoretically oppositional relation between intrinsic motivation and amotivation, we expected that higher levels of intrinsic motivation among gifted students would coincide with lower levels of amotivation (H1c).

Second, this study aimed to address age-related developments in motivation. Given the scarcity of longitudinal studies, it is unclear how motivation of intellectually gifted students changes over time and across different grades. In the present study, we looked at changes over time (across two school years) and cross-sectional differences between grades (Grade 3, 4, and 5), as both can provide insights into age-related developments in motivation. A negative trend in autonomous forms of motivation has been observed repeatedly among general school populations (e.g., Opdenakker et al., 2012; Spinath & Spinath, 2005). If intellectually gifted students feel underchallenged in regular mixed-ability school classes (Feuchter & Preckel, 2021), this decline may be more pronounced for them (H2a), and this may coincide with increases in controlled motivation (H2b) and/or amotivation (H2c).

Third, students can endorse multiple types of motivation simultaneously. It is unclear what specific combinations of motivation may occur among intellectually gifted students. Aligning with Hypotheses H1a and H1c (which assume higher mean levels of autonomous types of motivation and lower levels of amotivation among gifted students), gifted students may be overrepresented in profiles high on autonomous forms of motivation (H3a) and profiles low on amotivation (H3b). In addition, we explored the stability of profiles and profile membership across the two school years for both groups.

2. Method

2.1. Dataset and participants

The data were collected at 11 schools which were all participating in the educational research lab POINT (Dutch abbreviation for 'Adequate Education for Every New Talent') in which primary schools collaborate with universities to conduct practice-oriented research with regard to educating gifted students. A large set of data was collected to answer the schools' questions and the dataset was also intended for scientific research. So far, three papers have been published using data from this dataset. This includes a study on teachers' motivating teaching strategies for gifted and non-gifted students in regular classes and how these strategies are associated with students' motivation for school (Hornstra et al., 2020), a study on high-ability students' motivation in pull-out classes compared to regular classes (Hornstra et al., 2022), and a study on sensory processing sensitivity among high-performing students (Samsen-Bronsveld et al., 2022). The previous papers had different foci and only included a single measurement, whereas the present study utilized data from both waves to study age-related developments in motivation.

The sample of the present study consisted of 62 classes with 1438 students (52.4% girls). At the first wave, the students were in Grade 3 (32.7%), 4 (34.0%), or 5 (33.3%). These grades correspond to 'Group 5' to 'Group 7' in the Netherlands. At the second wave, the students were in Grade 4 (31.0%), 5 (35.7%), or 6 (33.3%). The average age of the students at the first wave was 9.4 years (*SD* = 0.98; range 8–14 years).

2.1.1. Clinically diagnosed gifted children

Intellectual giftedness was based on existing information of those students whose IQ had been tested. Intellectually gifted children were students who had an IQ above 120. Of note, not all children in our sample were tested, and this is not routine practice in the Netherlands.

Instead, this is done when there is a suspicion that a child may have above-average cognitive ability and/or when the educational needs of the child are not being met. Teachers were asked to indicate which students were classified as gifted by a licensed psychologist, in such cases, they have an IQ above at least 120 on a validated IQ-test. Teachers were also asked to state which other students had their IQ tested and to report the IQ score. If these students were tested with a validated IQ test and had an IQ above 120, they were also included in the intellectually gifted group. This resulted in a sample of 79 intellectually gifted students (5.5%) with a high-IQ. On average, each class contained 1.3 clinically diagnosed gifted students. Henceforth, we refer to this sample as 'gifted'. Of the gifted sample, 84.6% attended a pull-out (enrichment) class for about 2–3 hr a week, and attended a regular mixed-ability class during the rest of the school week.

2.2. Procedure

All schools of the educational research lab participated in the present study. Each school had a representative (a teacher or school counsellor) who took part in the educational research lab on behalf of their school and who helped to organize data collection at their schools. The study was approved by the local Institutional Review Board [Bakx16-12-2020 FCEO]. Consent was obtained from parents, teachers, and students. Nine students (0.45%) did not participate because their parents objected to their participation in the study. The data were collected in two consecutive school years (in February/March 2018 and 2019). Before the first data collection, teachers were sent a rating sheet on which they filled out demographic information on each participating student in their class and information on whether students had been classified as gifted.

At both waves, the schools were visited by a research assistant, who administered the questionnaires to the students. Students first received an introduction explaining the general purpose of the study and how to fill out the questionnaires. It was explained that their scores would be treated confidentially. The questionnaire started with demographic questions and continued with scales on and motivation. The questionnaires also contained additional scales not used in the present study.

2.3. Instruments

All scales were translated from English to Dutch using a back-translation procedure (Brislin, 1970). The items could be answered on a five-point Likert scale ranging from totally not applicable to me (1) to totally applicable to me (5).

Students' motivation for school was measured with the Self-Regulation Questionnaire - Academic (SRQ-A) (Ryan & Connell, 1989). All items were preceded by the question 'Why do I work on my schoolwork?'. The four subscales were *Intrinsic Regulation*, *Identified Regulation*, *Introjected Regulation*, and *External Regulation* (see Table 1 for example items). Integrated Regulation was not included as a separate subscale in the SRQ-A. *Amotivation* was assessed by the scale amotivation from the Academic Motivation Scale by Vallerand et al. (1992). For students who attended a pull-out class, it was explicitly mentioned that the questions referred specifically to their regular mixed-ability class and the preceding question was formulated as "Why do I work on my schoolwork in my regular class?". At the end of the questionnaire they also received questions on their pull-out class, as this data collection was part of a larger study. Confirmatory factor analyses (CFAs) were conducted to examine the factor structure of the motivation scales. Three models were compared: a five-factor model with the factors intrinsic, identified, introjected, and external regulation, and amotivation; a three-factor model with the factors autonomous motivation (intrinsic and identified regulation), controlled motivation (introjected and external regulation), and amotivation; and a one-factor model with a single motivation factor. At both waves, the five-factor model had better fit than the other models (see Table A1 in the online supplementary materials for fit statistics). Items with factor loadings below 0.50 were removed from the model (Perry et al., 2015), resulting in the removal of one item from the external regulation scale and one from the amotivation scale. Partial metric invariance was established, indicating that meaningful comparisons across groups can be conducted (Byrne et al., 1989). See Table A2 in the online supplementary materials for detailed results of the measurement invariance analyses. Internal consistencies are reported in Table 1. The internal consistencies were above or approached the commonly recommended cut-off value for Cronbach's alpha of 0.70 (Peterson, 1994; Streiner, 2003).

2.4. Data-analyses

Missing value analyses. The data were subject to attrition: 1438 students participated in Wave 1, of which 178 students (12.4%) were absent during Wave 2. Students who only participated in Wave 2 were not considered as we did not have IQ information on those students. Missing value analyses indicated that missingness at Wave 2 was unrelated to giftedness or gender or to values on the motivational variables at the other wave (p values all >0.05). Moreover, Little's MCAR test was not significant ($\chi2$ (207) = 204.69; p = .532), suggesting that the missing values were Missing At Random (MAR) (Schafer & Graham, 2002). The missing values were handled through the full information maximum likelihood method.

2.4.1. Main analyses

The analyses were performed with Mplus 8.6 (Muthén & Muthén, 2017). To examine mean-level differences in motivation between gifted and their classmates (H1a-c), we estimated a model for each dimension of motivation in which the motivational dimensions were estimated separately for Time 1 and Time 2. Including these dimensions as latent factors reduces the effects of measurement error. We included giftedness as an observed predictor in these models. If this predictor was significant, it would indicate a significant difference in motivation between gifted students and their classmates. We controlled for students' gender and grade to take into account that girls were underrepresented in the clinically diagnosed gifted sample (boys were 1.19 times as likely to be in the clinically diagnosed gifted group) and to account for possible differences in the distribution of students across grades.

Second, to examine differences in motivation over time (from Wave 1 to Wave 2) and between Grades (H2a-c), a latent change model (Geiser, 2020; McArdle & Hamagami, 2001) was estimated for each dimension of motivation. Based on the observed indicators of motivation at Time 1 and Time 2, this model estimates a latent intercept factor which can be

Table 1
Scales, example items, and internal consistencies.

Scale	*N* of items	Example item	α_{T1}	α_{T2}
		Why do I work on my schoolwork?		
Intrinsic regulation	4	• Because I enjoy doing my schoolwork.	0.80	0.84
Identified regulation	4	• Because it's important to me to work on my schoolwork.	0.71	0.70
Introjected regulation	3	• Because I'll be ashamed of myself if it didn't get it done.	0.68	0.70
External regulation	4	• Because I want the teacher to think I'm a good student.	0.68	0.65
Amotivation	3	School does not interest me.	0.69	0.75

interpreted as the initial level of motivation at Time 1 and a latent change factor representing the change in motivation from Time 1 to Time 2. Giftedness was included as an observed predictor of both latent factors to assess whether gifted children differed from their classmates in their initial level of motivation or in changes in motivation over time. We included grade as a predictor of both latent factors to indicate whether students' motivation differed between students in different grades, and we included the interaction between Grade and Giftedness to examine whether grade differences in motivation were similar for gifted students and other students. In these analyses, we also controlled for students' gender.

To account for the multilevel structure of the data (students nested in classes) in the aforementioned analyses, we applied the method of cluster-robust standard errors in all analyses (i.e., TYPE = COMPLEX in Mplus). This method adjusts the standard errors to account for the non-independence of the data (McNeish et al., 2017). In the models described above, model fit was evaluated based on the Comparative Fit Index (CFI), the Root-Mean-Square Error of Approximation (RMSEA), the Standardized Root Mean Square Residual (SRMR), and the Chi-square. A CFI above 0.90 indicates acceptable fit and above 0.95 indicates good fit of a model. An RMSEA below 0.05 indicates good fit, values between 0.05 and 0.08 indicate reasonable fit, and values above 0.10 indicate poor fit. A SRMR below 0.08 indicates good fit (Hu & Bentler, 1999; Kline, 2015).

Third, latent profile analyses (LPA) (Magidson & Vermunt, 2002; Spurk et al., 2020) were conducted to identity motivational profiles and to examine whether certain profiles were more or less prevalent among gifted students (H3a-b). The LPA was conducted for the Time 1 and Time 2 data. LPA has several advantages compared to traditional cluster techniques, mainly because it is model-based and therefore the model fit of solutions with different numbers of clusters can be compared. Moreover, with LPA, it is possible to take classification inaccuracy into account. Models from one up to eight profiles were estimated and compared, based on the following criteria (Spurk et al., 2020): (1) the AIC, BIC, and SA-BIC, with models with smaller values preferred over models with larger values (Magidson & Vermunt, 2002); (2) the adjusted Lo–Mendel–Rubin Likelihood Ratio Test (LMR) and the Bootstrapped Likelihood Ratio Test (BLRT) (Nylund et al., 2007), with significant *p*-values indicating that a model with a 'k' number of profiles outperforms a model with *k* minus 1 profile; (3) entropy values and latent profile probabilities (Spurk et al., 2020), with models with higher classification accuracies being preferred; (4) parsimony, with solutions with fewer profiles were preferred over solutions with more profiles, especially if additional profiles were only minor variations of profiles found in previous solutions or if additional profiles included <1.0% of the sample (Spurk et al., 2020); (5) the interpretability of the solutions. Thereafter, we used random effect Multilevel Latent Profile Analysis (MLPA; Mäkikangas et al., 2018), to assess whether the obtained clusters were differently distributed across different classes. Thereafter, we explored the stability of profiles and profile membership across the two school years for both groups using Latent Transition Analysis (LTA). LTA is an extension of LPA can be used to estimate the probabilities of participants transitioning from one profile to another. More specifically, we estimated an LTA model with Random Intercepts (RI-LTA). This model is less restrictive than the traditional LTA models and leads to better estimations of the transition probabilities (Muthén & Asparouhov, 2022). Next, we included giftedness as an predictor in the RI-LTA. Specifically, we regressed the latent profiles and the transitions on giftedness using multinomial logistic regressions. This way we could investigate whether gifted students were more likely than other students to be classified in certain profiles or make certain transitions between profiles compared to their classmates.

3. Results

3.1. Descriptives and preliminary analyses

Table 2 presents the descriptive statistics of the variables of the present study for the full sample and separately for gifted students and their classmates. For the purpose of interpretation, we report the observed (raw) mean scores in Table 2 rather than the latent factors that were used in subsequent analyses. Additionally, Table C1 in the online supplementary materials also shows the descriptives split by Grade. As an additional check on the potential confounding effect of pull-out class attendance, we compared the motivation in the regular class of gifted students who did and did not attend a pull-out class by means of *t*-tests. Findings revealed that there were no statistically significant differences in any of the dimensions of motivation at each time point (*p* values all >0.05). This would suggest that participation in a pull-out class is unlikely to account for differences in motivation in the regular class between the gifted children and their classmates.

To assess the distribution of the variance in each aspect of motivation at the two levels (class and student level), intraclass correlations were calculated. As suggested by Dyer et al. (2005), the ICCs were estimated for each indicator variable (the scores on the items). The range of the ICCs across the indicators for each latent variable is reported in Table 2. They indicate that a relatively small portion of variance in the motivation variables (1–9%) was situated at the classroom level, suggesting that there were limited differences between classes. Nevertheless, to account for the class-level variance, subsequent analyses took into account the multilevel nature of the data by correction of the standard errors (McNeish et al., 2017). Table 3 shows the correlations between the study variables, including the test-retest stability across waves. The latter indicated moderate stability levels ranging between 0.46 and 0.55, which suggests that there was room for rank-order change.

Table 2
Descriptive statistics of study variables for the total group, and separately for gifted students and their classmates.

	Total group				Gifted students			Classmates		
	n	*M*	*SD*	*ICCs (range)*	*n*	*M*	*SD*	*n*	*M*	*SD*
Time 1										
Intrinsic regulation	1425	4.06	0.71	0.01–0.02	77	4.17	0.64	1348	4.06	0.71
Identified regulation	1422	4.34	0.58	0.01–0.04	79	4.36	0.58	1343	4.34	0.58
Introjected regulation	1424	3.73	0.74	0.02–0.04	79	3.49	0.67	1345	3.75	0.74
External regulation	1411	2.81	1.01	0.07–0.09	78	2.69	0.96	1333	2.82	1.01
Amotivation	1415	1.80	0.85	0.02–0.03	77	1.85	0.81	1345	1.80	0.85
Time 2										
Intrinsic motivation	1255	3.93	0.72	0.05–0.06	67	4.03	0.67	1188	3.92	0.72
Identified motivation	1249	4.30	0.54	0.04–0.06	67	4.23	0.50	1182	4.31	0.55
Introjected regulation	1246	3.51	0.76	0.04–0.05	65	3.61	0.77	1181	3.50	0.76
External regulation	1244	2.56	0.92	0.03–0.07	67	2.54	0.81	1177	2.57	0.93
Amotivation	1251	1.80	0.79	0.03–0.04	67	2.06	0.85	1184	1.79	0.79

Table 3
Correlations between latent variables at Time 1 (T1) and Time 2 (T2).

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Intrinsic regulation T1	1.00									
2. Identified regulation T1	0.72***	1.00								
3. Introjected regulation T1	0.50***	0.61***	1.00							
4. External regulation T1	−0.22***	−0.22***	0.18**	1.00						
5. Amotivation T1	−0.48***	−0.64***	−0.18**	0.45***	1.00					
6. Intrinsic regulation T2	0.54***	0.36***	0.29***	−0.10*	0.28***	1.00				
7. Identified regulation T2	0.35***	0.46***	0.30***	−0.10*	−0.37***	0.74***	1.00			
8. Introjected regulation T2	0.29***	0.28***	0.55***	−0.11*	−0.10	0.56***	0.65***	1.00		
9. External regulation T2	−0.23***	−0.22***	0.00	0.51***	0.37***	−0.41***	−0.50***	−0.14**	1.00	
10. Amotivation T2	−0.32***	−0.29***	−0.14***	0.20***	0.47***	−0.54***	−0.74***	−0.40***	0.56***	1.00

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4
Model predicting motivation by giftedness (unstandardized coefficients).

	Intrinsic Regulation T1	Identified Regulation T1	Introjected Regulation T1	External Regulation T1	Amotivation T1
Covariates					
Gender (1 = female; 0 = male)	0.01	0.05	−0.04	−0.22***	−0.23***
Grade	0.02	0.04	−0.05***	−0.32***	−0.07*
Main predictor					
Giftedness	0.13*	0.02	−0.17**	−0.08	0.08
Explained variance					
ΔR^2	0.001	0.000	0.010	0.001	0.000
	Intrinsic Regulation T2	**Identified Regulation T2**	**Introjected Regulation T2**	**External Regulation T2**	**Amotivation T2**
Covariates					
Gender (1 = female; 0 = male)	−0.01	0.07*	0.03	−0.23***	−0.23***
Grade	−0.06	−0.03	−0.05**	−0.14***	0.01
Main predictor					
Giftedness	0.13	−0.07	−0.02	−0.05	0.25**
Explained variance					
ΔR^2	0.001	0.002	0.000	0.001	0.007

* $p < .05$, ** $p < .01$, *** $p < .001$.

3.2. Motivational differences between gifted students and their classmates

To test the hypothesis of mean-level differences in motivation between gifted students and their classmates (H1a-c), we estimated models in which the latent factors (motivation at Time 1 and Time 2) were predicted by giftedness, while controlling for gender and grade. The findings are reported in Table 4. In these models, we corrected for the nested structure of the data. All models fitted the data well. The fit statistics are reported in the online supplementary materials (Table B1).

The regression coefficients reported in Table 4 indicate that most aspects of motivation did not differ based on giftedness. In line with the expectation that gifted students would report higher levels of autonomous types of motivation (i.e., intrinsic and identified regulation) (H1a), we found a statistically significant difference, but only in intrinsic regulation at Time 1 ($B = 0.13$, $p = .045$) and thus not in identified regulation. That is, gifted students reported a higher level of intrinsic motivation at Time 1 than their classmates. The corresponding effect size for the mean difference is Cohen's $d = 0.23$, suggesting a small difference (Cohen, 1988).

Moreover, it was expected that there would be no differences in controlled motivation (i.e., introjected and external regulation) (H1b). This was confirmed for external regulation, but we did find a statistically significant difference in introjected regulation at Time 1. Gifted students reported less introjected regulation at Time 1 than their classmates ($B = -0.17$, $p = .001$). The corresponding effect size for the mean difference is Cohen's $d = 0.29$, suggesting a small to medium difference (Cohen, 1988). Lastly, we hypothesised lower levels of amotivation among gifted students (H1c). However, our findings indicated that gifted students reported *more* amotivation at Time 2 than other students ($B = 0.25$, $p = .005$). The corresponding effect size for the mean difference is Cohen's $d = 0.39$, suggesting a small to medium difference (Cohen, 1988). The ΔR^2 reported in Table 4 indicates the difference in explained variance in the model with giftedness versus a baseline model with only the covariates. These ΔR^2 values indicate that for all motivation variables, <1% of the variance could be attributed to giftedness.

3.3. Motivational changes

To assess age-related differences in motivation for gifted students and their classmates (Hypotheses 2a-c), we estimated a latent change model. Again, we corrected for the nested structure of the data. In this model, the initial level of motivation at Time 1 and the latent change were estimated as latent factors. Giftedness was included as a predictor of both latent factors, while we controlled for gender and grade. As indicated by the fit statistics (see Table B2 in the online supplementary materials), all models fitted the data well.

The regression coefficients are reported in Table 5. We hypothesised that autonomous motivation (i.e., intrinsic and identified regulation) would decline for all students between the two waves, but more strongly for gifted students (H2a). As expected, intrinsic regulation showed a significant decline across both waves ($B = -0.16$, $p < .001$). However, the rate of this decline did not differ between gifted students and their classmates. Moreover, there was no statistically significant decline in identified regulation ($B = -0.04$, $p = .075$), but there was a significant difference between gifted students and their classmates in the latent change factor ($B = -0.19$, $p = .015$). This difference implied that there was a decline in identified regulation between T1 and T2 for gifted students, but not for their classmates (see Fig. 1).

Additionally, we also examined whether motivation declined with age by comparing the different grades. There were no statistically significant main effects of grade on either type of autonomous motivation (i.e., intrinsic and identified regulation), indicating that there were no

Table 5
Model predicting the latent factors motivation and motivational change by giftedness (unstandardized coefficients).

	Intrinsic Regulation	Identified Regulation	Introjected Regulation	External Regulation	Amotivation
Latent factors					
Motivation	4.01***	4.55***	4.39***	2.28***	2.06***
Change motivation	−0.16***	−0.04	−0.08***	−0.23***	0.01
Covariate					
Gender (1 = female; 0 = male)	0.00	0.06*	−0.07	−0.22	−0.23***
Main predictors					
Giftedness → Motivation	0.12	−0.03	−0.13	−0.14	0.07
Giftedness → Change motivation	−0.06	−0.19*	0.10	0.36**	0.41**
Grade	−0.02	0.01	−0.05***	−0.23***	−0.04
Giftedness × Grade → Motivation	−0.01	−0.06	0.03	−0.05	−0.08
Giftedness × Grade → Change Motivation	−0.06	−0.11	−0.04	0.36**	0.28*
Explained variance					
R^2 motivation	0.00	0.01	0.02	0.09	0.03
R^2 change motivation	0.00	0.01	0.01	0.01	0.01

* $p < .05$, ** $p < .01$, *** $p < .001$.

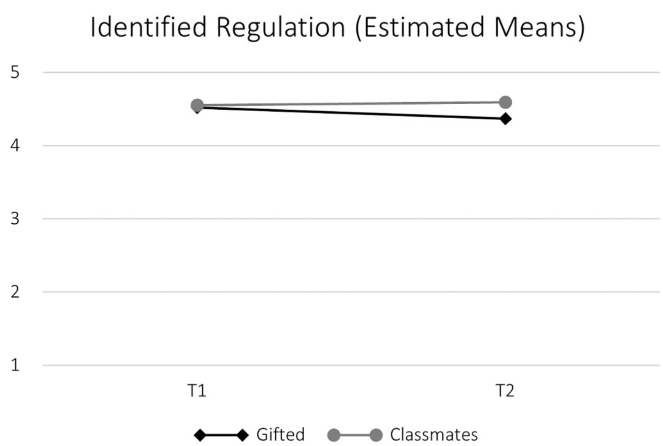


Fig. 1. Latent change in identified regulation for gifted students and classmates.

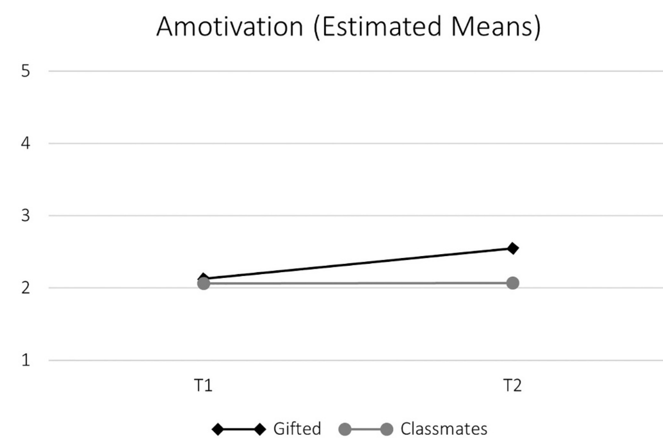


Fig. 3. Latent change in amotivation for gifted students and classmates.

statistically significant differences between students in different grades. Moreover, the interactions between grade and giftedness on the latent factors motivation and change in motivation were not statistically significant for intrinsic and identified regulation. This suggests that, contrary to expectations, there were no significant age-related differences between gifted students and their classmates in terms of their autonomous motivation.

Moreover, we expected increases in controlled motivation (i.e., introjected and external regulation) and amotivation between the two waves, which we expected to be more pronounced for gifted students compared to their classmates (H2b and H2c). Contrary to expectations, students' introjected and external regulation declined between the two waves ($B = -0.08$, $p < .001$; $B = -0.23$, $p < .001$, respectively). But, as expected, the findings suggest that gifted students showed an increasing trend in external regulation, while their classmates showed a declining trend, as indicated by the significant effect of giftedness on change in motivation ($B = 0.36$, $p = .006$), see also Fig. 2. As similar pattern of findings was obtained for amotivation ($B = 0.41$, $p = .006$), see Fig. 3. That is, the findings suggest that amotivation increased between the two waves for gifted students, while it remained relatively stable for their classmates.

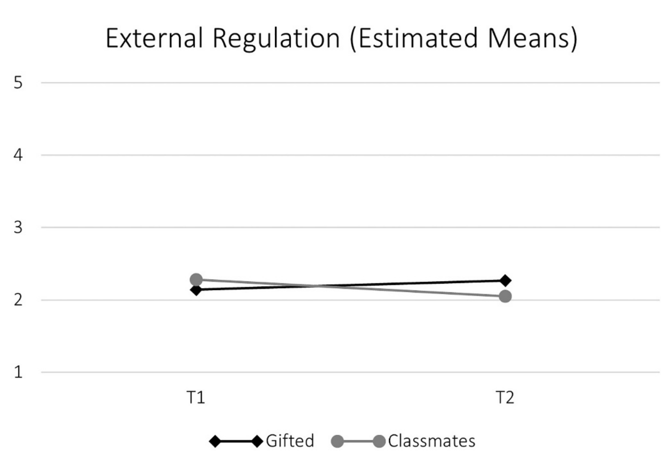


Fig. 2. Latent change in external regulation for gifted students and classmates.

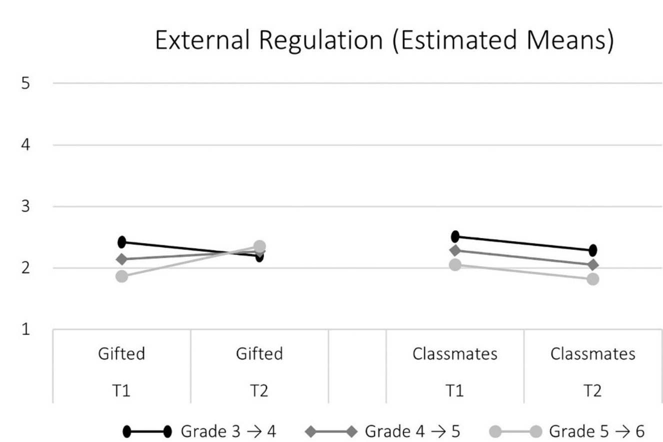


Fig. 4. Interaction between Giftedness and Grade on External Regulation.

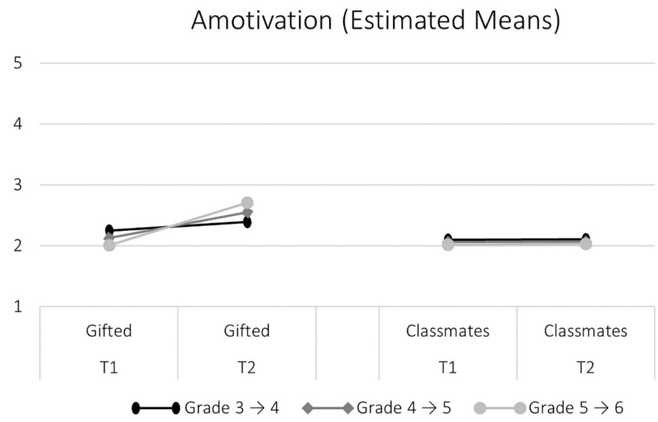


Fig. 5. Interaction between Giftedness and Grade on Amotivation.

Again, we also compared motivation across the different grades. These findings suggest that, contrary to expectations, students in higher grades reported lower levels of introjected and external regulation ($B = -0.08$, $p < .001$; $B = -0.23$, $p < .001$, respectively). The interactions between giftedness and grade on the intercept of motivation, and on latent change in intrinsic, identified, and introjected motivation were not statistically significant, but the interactions between giftedness and grade on latent change in motivation were significant for external regulation and amotivation ($B = 0.36$, $p = .002$; $B = 0.28$, $p = .028$). Figs. 4 and 5 depict these interactions. Fig. 4 shows that classmates' *External Regulation* declines for each grade cohort, but for clinically diagnosed gifted students the patterns differed by grade. Especially for gifted students who were in Grade 5 at Wave 1, external regulation showed an increasing trend. For amotivation, the figure shows that for classmates, amotivation was stable between the two waves for each of the three grade cohorts, but for gifted students there was an increasing trend, which was stronger for students in higher grades. Hence, for both external regulation and amotivation, an unfavourable trend (increase) could be observed among clinically diagnosed gifted students, especially those in the higher grades of primary school.

The R^2 values in Table 5 indicate that the variables in the model explained between 0% and 9% of the variance in the latent motivation factors, and between 0% and 1% of the variance in the latent change factors.

3.4. Motivational profiles

To examine whether gifted students displayed a different combination of motivation types (profiles) and made different transitions between profiles across the two waves, first LPAs were performed for each wave to determine the number of profiles, which were then followed by an RI-LTA (Muthén & Asparouhov, 2022) to examine the transitions between profiles across the two waves. Thereafter, giftedness was included as a predictor of profile membership and transitions.

Table 6 shows the fit statistics of the LPAs for the first wave and second wave. The five-profile solution was considered the best representation of students' motivational profiles at both waves for multiple reasons. First, the results of the LMRA were in favour of the five-profile solution for both waves. Second, although all solutions had acceptable entropy values (> 0.70), the five-profile solutions had very high average latent class probabilities for the most likely latent class membership (values above 0.79 on the diagonal; see Table C2 in the Supplementary Materials), which suggests a clear classification attained with the five-profile solutions. Third, although most of the fit indices (AIC, BIC, SA-BIC, BLRT) indicated better fit for the models with even more profiles, it was found that solutions with more than five profiles only included minor variations of the first five profiles and included small clusters with fewer than 1% of the sample. Fourth, other solutions lacked substantive interpretation.

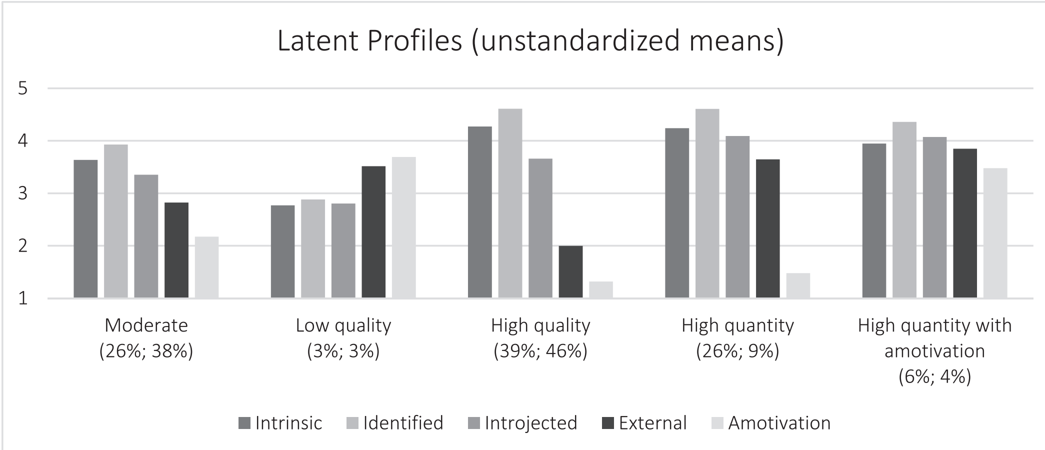
The results of the random effect Multilevel LPA showed that the size of the latent profiles did not vary statistically significantly between classes (Time 1: Variance estimate = 0.070, SE = 0.464, $p = .881$; Time 2: Variance estimate = 0.072, SE = 0.671, $p = .951$). The subsequent latent transition analyses were therefore conducted without further considering the multilevel structure of the data.

The profile configurations were mostly similar at both waves, with a small difference for the fifth profile (see Fig. S1 and S2 in the online supplementary materials for details). Next, the LTA-RI was performed. The profile means were constrained to be equal across both waves. This resulted in slightly lower, but still sufficient classification accuracies (entropies were 0.70 and 0.73 for Time 1 and 2, respectively) as compared to the LPA results. Also the probabilities of profile membership shifted somewhat. Fig. 6 shows the final profile configuration of the LTA-RI (unstandardized and standardized).

In labelling the profiles, we considered both the raw unstandardized means on each motivational dimension and the standardized means. The first profile was characterized by moderate (around average) scores on each variable. This profile was therefore referred to as “Moderate”. At the first wave, this was the most likely profile for 26% of the students, and at the second wave, it was even more prevalent (38% of the students). The second profile was characterized by relatively low scores on the two autonomous forms of motivation and relatively high external regulation and amotivation. The profile was therefore called “Low Quality”. This profile was the least likely profile at both waves

Table 6
Fit statistics and entropy for the latent profile solutions at Wave 1 and Wave 2.

K	AIC	BIC	SA-BIC	Entropy	LMRA	BLRT
Wave 1						
1	16,318.570	16,371.280	16,339.514	–	–	–
2	15,446.502	15,530.839	15,480.012	0.76	0.0017	0.0000
3	15,045.893	15,161.855	15,091.969	0.80	0.0610	0.0000
4	14,770.756	14,918.344	14,829.397	0.83	0.0019	0.0000
5	14,599.288	14,778.502	14,670.496	0.78	0.0000	0.0000
6	14,474.491	14,685.332	14,558.265	0.75	0.3604	0.0000
7	14,395.187	14,637.653	14,491.526	0.77	0.0264	0.0000
8	14,328.224	14,602.317	14,437.130	0.76	0.2204	0.0000
Wave 2						
1	14,844.534	14,896.568	14,864.803	–	–	–
2	13,837.315	13,920.570	13,869.745	0.70	0.0001	0.0000
3	13,418.265	13,532.740	13,462.855	0.79	0.0502	0.0000
4	13,266.376	13,412.071	13,323.127	0.79	0.0798	0.0000
5	13,123.830	13,300.745	13,192.742	0.77	0.0013	0.0000
6	13,046.817	13,254.953	13,127.890	0.78	0.4750	0.0000
7	12,979.211	13,218.568	13,072.446	0.79	0.3037	0.0000
8	12,916.248	13,186.825	13,021.644	0.77	0.0676	0.0000



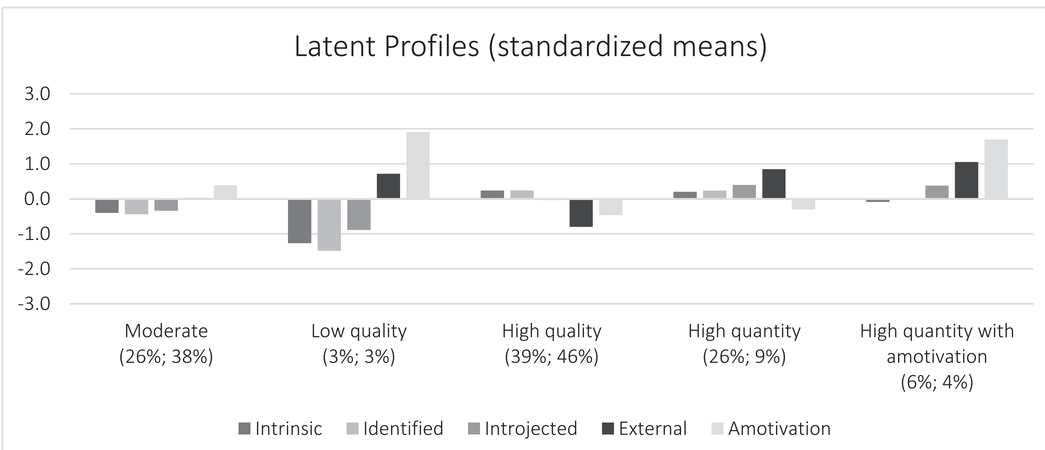


Fig. 6. Unstandardized and standardized means of motivational variables per profiles with estimated percentages for Time 1 and Time 2.

containing 3% of the students at both the first and second wave, respectively. The third profile consisted of students with relatively high autonomous types of motivation and lower scores on more externally regulated motivation and amotivation and was therefore considered “High Quality”. This profile was found in 39% and 46% of the students at Wave 1 and 2, respectively. The fourth profile was called “High Quantity” as students in this profile reported relatively high scores on all types of motivation combined with low amotivation. For 26% and 9% of the students, this was their most likely profile at both waves. The last profile resembled the High Quantity profile as it also had relatively high scores on the autonomous and controlled types of motivation. However, this was combined with high amotivation, which can be considered theoretically unlikely as the presence of amotivation suggests the absence of other types of motivation. This profile was called “High Quantity with Amotivation”. For 5.8% and 13.5% of the students this was the most likely profile at Wave 1 and 2, respectively.

Table 7 shows the probabilities of students transitioning between profiles. These probabilities refer to within-group probabilities (e.g., an estimated 24% of the children who were in the moderate profile at Time 1 had transitioned to the high quality profile at Time 2). Most students (55%) remained in the same profile (probabilities on the diagonal), while 45% transitioned to a different profile. Fig. 8 displays the transition probabilities graphically. This figure shows the probabilities for the entire sample (e.g., an estimated 18% of the full sample stays within the moderate profile). Fig. 8 shows that the moderate and high quality profile increased in size, mostly due to influx from the high quantity profile, which in turn decreased in size.

We added Giftedness as predictor in the LTA-RI to examine whether gifted students were statistically more likely to be classified in certain profiles over others, and whether they were more likely to make certain transitions. The findings regarding the differences in profile frequencies are reported in Table 8. Significant Odd Ratios indicate that a profile is more or less likely for gifted students compared to other students. The findings indicate that at Time 1, gifted students were more likely than other students to be in the Moderate profile and less likely to be in the High Quantity profile. At Time 2, gifted students were more likely than

Table 7
Transition probabilities per profile.

	Profile Time 2				
Profile Time 1	Moderate	Low Quality	High Quality	High Quantity	High Quantity with Amotivation
Moderate	0.70	0.02	0.24	0.03	0.02
Low quality	0.42	0.25	0.19	0.09	0.06
High quality	0.25	0.02	0.73	0.00	0.01
High quantity	0.26	0.03	0.39	0.26	0.06
High quantity with amotivation	0.42	0.10	0.03	0.28	0.17

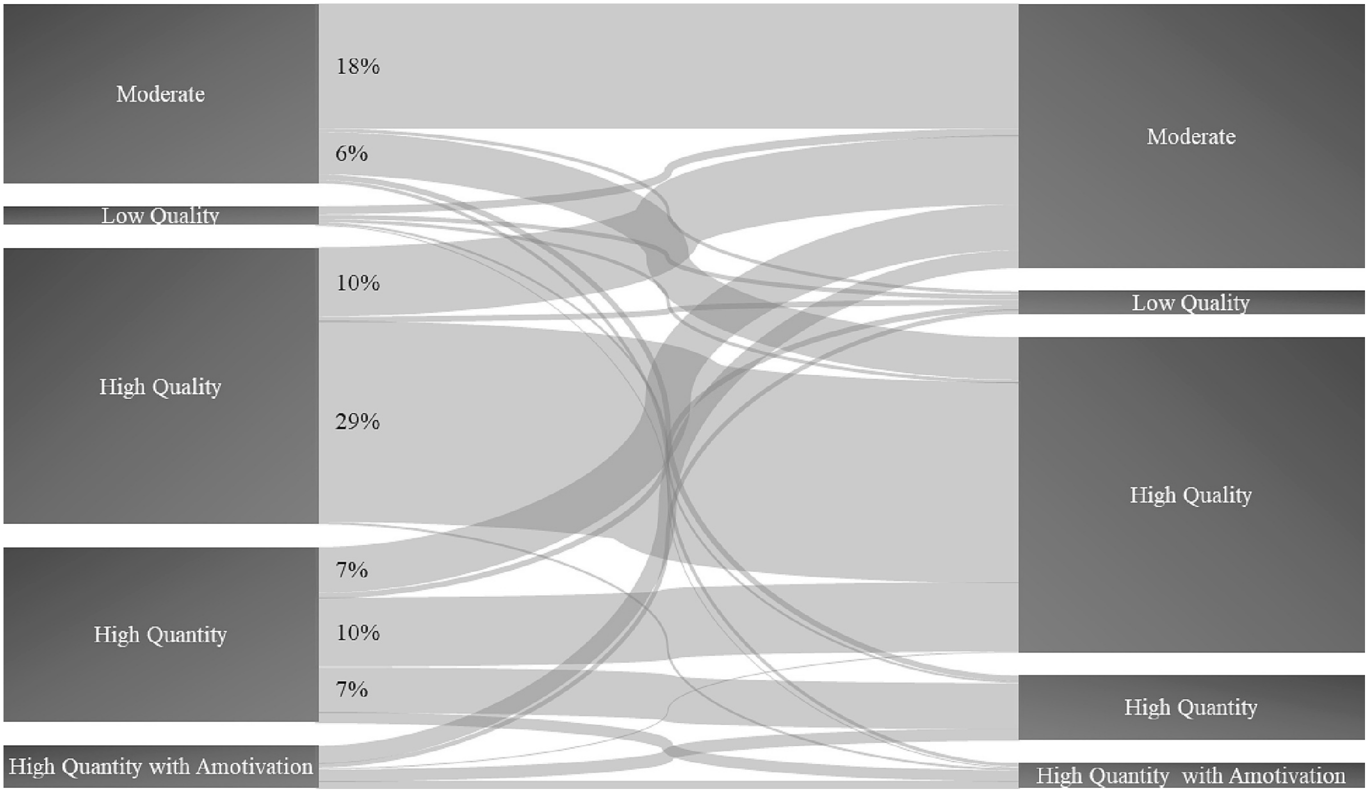


Fig. 8. Transition probabilities for the full sample.
Note. Only transition probabilities above 5% are labelled in the figure.

Table 8
Intellectual giftedness as predictor of profile membership.

	Time 1		Time 2	
	OR	CI (95%)	OR	CI (95%)
Moderate	1.68*	1.05–2.67	2.14*	1.136–3.37
Low quality	2.35	0.90–6.13	1.15	0.27–4.90
High quality	1.15	0.73–1.80	0.46*	0.28–0.74
High quantity	0.25*	0.11–0.58	0.29	0.07–1.23
High quantity with amotivation	0.81	0.29–2.27	3.01*	1.23–7.38

Note. OR values indicate how much more likely an gifted student is to be in a certain profile compared to another. OR = Odd Ratio, CI = Confidence Interval. * $p < .05$.

other students to be in the Moderate profile and the High Quantity with Amotivation profile, and less likely to be in the High Quality profile.

The LTA-RI with giftedness a covariate also indicates whether gifted students were more likely than their classmates to make certain transitions. Table 9 shows the odds ratios and indicates that gifted students were statistically more likely than their classmates to transition from the High Quality to the Moderate Profile and from the High Quality to the High Quantity with Amotivation profile – both of which can be considered unfavourable transitions, and less likely to make the opposite, more favourable, transitions.

4. Discussion

The present study investigated the motivation of clinically diagnosed gifted students and their classmates in regular mixed-ability classes. A better understanding of the motivational dynamics of intellectually gifted students is relevant to gain additional insights into how to provide optimal learning environments for these students in regular classes. The present study extended prior research (1) by focusing not only on intrinsic motivation, but also on other less self-determined forms of motivation, (2) by studying age-related differences in these motivational dimensions, and (3) by combining variable-centered and person-centered approaches to study both quantitative and qualitative differences in motivation of gifted and other students. By inclusion of other motivational dimensions besides intrinsic motivation in the variable-centered and person-centered techniques and by comparing the two groups over time, we were able to contribute to existing research and show a clearly distinct pattern of motivation between clinically diagnosed gifted students and their classmates. Overall, clinically diagnosed gifted students reported higher intrinsic motivation in their regular classes at Time 1. However, the other findings from both the variable-

Table 9
Giftedness as predictor of profile transitions (odds ratios).

	Profile Time 2				
Profile Time 1	Moderate	Low quality	High quality	High quantity	High quantity with amotivation
Moderate	1.00	0.77	0.38*	0.46	2.03
Low quality	1.30	1.00	0.50	0.60	2.63
High quality	2.62*	2.02	1.00	1.21	5.32*
High quantity	2.18	1.68	0.83	1.00	4.42
High quantity with amotivation	0.49	0.38	0.19*	0.23	1.00

Note. Odds ratio values indicate how much more likely an intellectually gifted student is to be in a certain profile compared to another. * $p > .05$.

and the person-centered approaches suggest that gifted students were more likely to show a declining pattern of identified regulation and to endorse unfavourable types of motivation (external regulation and amotivation) in their regular class compared to other students as they grew older. These findings seem to suggest that, although they start from a favourable motivational position, motivational problems among clinically diagnosed gifted students in regular mixed-ability classes may start to emerge toward the end of primary school. Below, these findings are discussed in more detail.

4.1. Motivational differences between gifted students and their classmates

Consistent with our expectations and prior research (Bergold et al., 2020; Gottfried and Gottfried, 1996; Wirthwein et al., 2019), clinically diagnosed gifted students reported more intrinsic motivation in their regular class (but only at Time 1). Furthermore, we expected similar levels of controlled types of motivation (Meier et al., 2014; Preckel et al., 2008) and lower amotivation, but the findings indicated that gifted students reported *less* introjected regulation in their regular class at Time 1 than their classmates. In addition, the findings suggested that with age, identified regulation decreased and external regulation and amotivation in their regular class increased for gifted students, but not for other students. Hence, while younger gifted students may initially show a more favourable motivational pattern than their classmates, these findings suggest that toward the end of primary school, this motivational disadvantage disappears and children diagnosed as gifted become less optimally motivated in their regular class than their mixed-ability classmates.

Overall, there are multiple factors which may have caused the motivational differences between clinically diagnosed gifted students and their classmates. Motivational differences can be caused by differences in personal characteristics that are associated with higher cognitive abilities. Prior research for example suggest that higher cognitive abilities are associated with a higher need for cognition (Lavrijsen et al., 2021). Such characteristics can cause intellectually gifted students to be more motivated to learn new things (intrinsic motivation). In addition, differences can also be caused by characteristics of the learning context or their social environment such as the educational provisions that are offered to gifted students. For example, when intellectually gifted children are underchallenged in their regular class (Feuchter & Preckel, 2021), this might compromise their motivation. Many of the clinically diagnosed gifted students in the present study (86.4%) attended a pull-out class once a week. These programs are designed to fit the specific needs of these students. Children may be highly motivated when attending such a program, but it may also cause them to become more critical of the learning context in their regular classroom (cf., Hornstra et al., 2022) and thereby evoke amotivation in their regular class. Future research could further investigate how contextual factors are associated with gifted children's motivation.

Confirming prior research (Boiché et al., 2008; Meens et al., 2018; Ratelle et al., 2007), the findings of the person-centered analyses indicated that students can endorse multiple types of motivation in their regular class simultaneously. Five different profiles were distinguished which were labelled as Moderate, Low Quality, High Quality, High Quantity, and High Quantity with Amotivation. We hypothesised that intellectually gifted students may be overrepresented in profiles high on autonomous forms of motivation and low on amotivation (i.e., the High Quality profile). These hypotheses were not confirmed. Instead, intellectually gifted students were, at the second wave, *less* likely than other students to be classified in the ‘High Quality’ profile, and more likely to be in the ‘High Quantity with Amotivation’ profile. Likewise, also the transitional analyses indicated that they were more likely to make transitions from theoretically more favourable to theoretically less favourable profiles from Wave 1 to Wave 2. These findings align with the variable-centered findings, suggesting that, over time, clinically diagnosed gifted students become somewhat less optimally motivated than their classmates.

We extended prior person-centered research by using longitudinal person-centered techniques and by also including amotivation in the profiles. The findings show the added value of these extensions, as we observed differences in transitions between clinically diagnosed gifted students and their classmates, and because amotivation acted in a unique manner in the profiles. For example the High Quantity profile was characterized by high levels of all motivational dimensions except amotivation, while the High Quantity with Amotivation Profile was characterized by high levels of all motivational dimensions including amotivation.

It is important to note that the motivational differences between clinically diagnosed gifted students and their classmates were relatively small. Overall, the findings of the profile analyses suggested that most of the clinically diagnosed students, like other students, tended to have relatively adaptive motivational profiles with regard to their motivation in their regular class. Still, a relatively large group of students (around 25% of the students) had a profile which is theoretically associated with suboptimal learning and lower well-being (i.e., the two low-quality profiles and the high-quantity profile). Given that motivation has been found to deteriorate with age (e.g., Corpus et al., 2009; Opdenakker et al., 2012), and according to this study's findings especially so for clinically diagnosed gifted students, this may be considered cause for concern.

4.2. Limitations

Some limitations need to be considered. First, current definitions of giftedness tend to move beyond the sole focus on IQ and focus more on talent development (Worrell et al., 2019). However, to be able to operationalize giftedness in a replicable way using a more homogeneous group for research purposes as recommended by Carman Carman (2013), we focused on intellectual giftedness and selected students based on an IQ cut-off score. It has to be acknowledged that for clinical and educational purposes, a broader perspective is recommended. However, including more characteristics of giftedness raises other difficulties, like valid and reliable assessment of these characteristics and the possibility of a more heterogeneous group of participants. Second, only those students who were clinically tested and had an IQ above 120 were included as gifted children. This could have formed a selection bias: it is possible that the participants in our study form a clinical subset of the actual gifted population, who might present more problems in the school context than gifted students in general. Also, it is plausible that there were also other children who could be considered gifted, but do not belong to a clinical sample. This suggests that the gifted students in our sample are the ones who were recognized as such early on. This could be because they visibly demonstrated outstanding cognitive abilities, in which case teachers or parents may instigate a clinical evaluation to assess the educational needs of the child (Hertzog et al., 2018). Alternatively, there may have been other reasons for involving a clinician, such as socio-emotional difficulties (Worrell et al., 2019). Hence, our findings only pertain to those students who are clinically diagnosed as gifted and cannot be generalized to all students with an IQ >120.

Third, a large majority of gifted students in the sample of the present study also participated in a pull-out program. Even though we made it very clear to students that our motivation measures specifically pertained to the regular mixed-ability class, their participation in a pull-out class may still have affected their motivation. Favourable levels of motivation in the pull-out class might either spill-over to the regular class, or might trigger contrast effects and thus result in lower motivation in regular class. A prior study on students attending a pull-out class, which was part of the same larger project as the present study (Hornstra et al., 2022), indicated that motivation of students who attend a pull-out class differs between the regular class and the pull-out class. That is, these students tend to report more favourable motivation in the pull-out class than in their regular class, suggesting a contrast effect. However, in the present study, we found no statistically significant differences in motivation between gifted students who were and who were not participating in a pull-out class. That said, the sample size of gifted students *not* participating in a pull-out class was very small so this findings has to be interpreted with caution.

Fourth, motivation was assessed using self-reports. We chose to use self-reports as motivation refers to the personal reasons students have for putting effort into their schoolwork. As such, self-report seems to be the most suitable way to address this. Nevertheless, self-reports may come with some limitations, such as self-presentation bias (Paulhus & Vazire, 2007). Fifth, the present study did not take into account characteristics of the classroom context that may explain why students endorse certain motivations. Future research could examine the contextual factors that contribute to adaptive motivational patterns among gifted students as well as other students. Lastly, in the latent transition analyses, the relatively small number of gifted students combined with small profiles might lead to an overinterpretation of the effect of giftedness on the transition probabilities. Future research among larger samples of gifted students (although this is typically hard to achieve) could attempt to corroborate these findings further. Nevertheless, our findings from the variable-centered analyses – which are less sensitive to this issue – aligned with the findings from the person-centered analyses and also suggest less motivational stability among gifted students.

4.3. Implications for research

The findings of the present study are consistent with several notions that have also emerged in prior research. In particular, three notions need to be considered in future research on (gifted) students' motivation. (1) Motivation is a multifaceted constructed and all facets need to be considered to get a complete picture. In case of this particular study, the inclusion of multiple motivational dimensions gave a more nuanced picture of clinically diagnosed gifted students' motivation as the findings revealed that these students were initially more intrinsically motivated for school, but toward the end of primary school, they also developed more amotivation in their regular class than their classmates. (2) Motivation is a dynamic construct. The findings of the present study, particularly the relatively low variable-centered stability and large number of students transitioning between profiles between both waves, along with many other studies on motivational change (Dietrich et al., 2022), show that it is important to take the dynamic nature of motivation into account. This can be done by accounting for longitudinal change, as was done in the present study, or it can be done by studying students' motivation at an even finer time resolution (cf., Flunger et al., 2022). (3) Motivation varies between individuals. Individual students can have quantitatively and qualitatively different patterns of motivation. The use of person-centered techniques can help to demonstrate and account for this variation. Even within a group of students who are relatively similar in terms of their intelligence (i.e., clinically diagnosed gifted students), a large degree of variation was found in the present study, as all five profiles emerged for gifted students. This suggests that future research and educational practices need to account for this variation rather than considering gifted students to be a homogeneous group with similar motivational needs.

4.4. Implications for practice

Findings from the latent profile analyses suggested that many students (clinically diagnosed gifted students as well as other students) display non-optimal motivational patterns characterized by relatively high levels of controlled motivation or amotivation. Especially students in the (moderate) Low Quality profiles may be at risk for disengagement and underachievement (Rubenstein et al., 2012). Clinically diagnosed gifted students were initially characterized by more favourable motivation, yet motivational problems among these students seemed to start to emerge toward the end of primary school (Grade 6). If teachers can identify students who start to become less motivated for school early on, it may be easier to intervene and prevent motivational problems and subsequent underachievement later on. To identify students who are at risk of developing an unfavourable motivational pattern, teachers or other educational professionals could regularly assess their students motivation, and regularly engage in talks with their students about their motivation. These talks should not just focus on their interests and likes (i.e., intrinsic motivation), but also what makes them feel pressured or causes them to disengage. Based on SDT research, teaching practices and interventions which support students' need for autonomy, structure, and relatedness are likely to foster students' motivation for school (Bureau et al., 2022; Hornstra et al., 2021; Stroet et al., 2013). The benefits of such need-supportive learning environments have been confirmed for general school populations as well as for gifted students (Hornstra et al., 2020).

Moreover, differences between profiles suggest that a tailored approach may be needed. For example, some students showed a motivational pattern with high external regulation and low levels of autonomous motivation (low quality), while other students showed a pattern with high external regulation and high autonomous motivation (high quantity). While these profiles are both considered to be maladaptive, they may require different strategies to help students to develop higher-quality motivation.

5. Conclusion

By including various types of motivation across SDT's motivational continuum, by comparing differences between grades, and by using latent profile analyses, the findings of the present study showed that the motivational dynamics of intellectually gifted students are more complex than them just being 'more' or 'less' motivated than other students. While the findings regarding the initial differences suggested that gifted students start out with slightly more favourable motivational patterns in their regular class than other students, the comparison between grades revealed that this motivational advantage seems to disappear toward the end of primary school. This highlights the importance of continuously monitoring the needs of those students who are either diagnosed as or suspected to be gifted from early grades on throughout primary education, in order to prevent the development of low-quality motivation and underachievement.

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CRediT authorship contribution statement

Lisette Hornstra: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **A.C. Sven Mathijssen:** Writing – review & editing. **Jaap J.A. Denissen:** Writing – review & editing. **Anouke Bakx:** Funding acquisition, Data curation, Writing – review & editing.

Declaration of competing interest

None.

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Appendix A. Supplementary materials

Supplementary data to this article can be found online at https://doi.org/10.1016/j.lindif.2023.102345.

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