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High-ability students in pull-out programs and regular classes: A longitudinal study on perceived social relationships in two settings

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ABSTRACT

Although there is wide support for the academic benefits of pull-out programs aimed at high-ability students, it remains unclear how attending these programs is associated with social outcomes. This one-year, three-wave longitudinal study examined the perceived social relationships with teachers and peers of 245 high-ability students in both their pull-out programs and regular classes and included 429 regular students as a reference group. Results of latent growth curve analyses revealed that high-ability students perceived their relationships with regular peers and teachers as equally positive as regular students. Furthermore, high-ability students initially perceived their relationships in their regular class and pull-out program as equally positive, but as the school year progressed, perceived relationships with peers developed slightly more negatively in their regular class. Overall, the findings raise the question whether or not high-ability students actually have a commonly shared need for interaction with like-minded peers and specialized teachers in a special program to experience positive social relationships. Furthermore, the findings suggest that it is important to consider not only the academic benefits, but also the potential social effects in both the regular class and the pull-out program, when selecting students for pull-out programs.

1. Introduction

Teachers in regular schools teach a heterogenous student population, which can make it challenging to create an encouraging learning environment for all students, including those with above average cognitive abilities (i.e., high-ability students; Reis & Renzulli, 2010). A variety of grouping strategies have been developed to offer high-ability students differentiated instruction (Delcourt, Cornell, & Goldberg, 2007). An often-used grouping strategy is a pull-out program, which takes high-ability students out of their regular classroom for a portion of the school week to let them attend a special class with other high-ability students (Swiatek & Lupkowski-Shoplik, 2003). In the Netherlands, pull-out programs have become increasingly popular in recent decades. Although recent numbers are unknown, in 2010 approximately 40% of primary schools were offering such programs to their high-ability students (Doolaard & Oudbier, 2010). Thus far, many studies found support for positive effects of pull-out programs on academic outcomes, with various meta-analyses (e.g., Hoogeveen, Hell, Mooij, & Verhoeven, 2004; Vaughn, Feldhusen, & Asher, 1991) supporting this. However, little attention has been paid to the *social* consequences of attending a pull-out program for high ability students

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(Delcourt et al., 2007; van der Meulen et al., 2014).

Several researchers have theorized that high-ability students benefit socially from being around "like-minded" peers and specialized teachers because they risk negative experiences in their regular classes. They may, for example, feel different or unappreciated by peers and teachers (e.g., Kao, 2011; Riley & White, 2016; Rinn, 2018; Rogers, 2007). Spending time with similarly abled peers may give high-ability students "a sense of recognition" (van der Meulen et al., 2014, p. 291) and allow them to select friends with similar traits, attitudes, and behaviors (Guo, 2006).

Emerging empirical evidence showing that high-ability students indeed benefit socially from interactions with other high-ability students and specialized teachers comes mainly from studies focused on *full-time* or *summer* programs (e.g., Cross & Swiatek, 2009; Rinn, 2006; Vogl & Preckel, 2014). However, the social experiences of high-ability students in a pull-out program may be different from those in full-time and summer programs. That is, pull-out programs carry the unique trait that participating students switch frequently between two educational settings: the pull-out program (usually one day a week) and the regular class (the other school days). High-ability students thus need to manage relationships with two groups of peers and two or more teachers. Thus, potential positive social experiences in the pull-out program may extend to the regular class, resulting in positive perceptions of social relationships in both settings. Conversely, the potential positive social experiences in the pull-out program may have a negative impact on how these students value their experiences in the regular class.

Given the increased popularity of pull-out programs, it is important to understand how the social relationships of high-ability students participating in a pull-out program develop. First, this study aimed to gain insight into how high-ability students perceive their social relationships in their regular class as compared to regular students. Next, to investigate whether a program with like-minded peers and specialized teachers helped high-ability students to develop higher-quality relationships, we compared the perceptions of their relationships in both the regular class and the pull-out program.

1.1. Social relationships in the classroom

Education is considered a social rather than an individualistic process, as students learn in interaction with their fellow students and teachers, and do not only have academic but also interpersonal needs (Ostermann, 2000). Positive relationships promote feelings of security in children (Roorda, Koomen, Spilt, & Oort, 2011; Wentzel, 2017). This security is considered essential for exploring and interacting with the environment. Strong ties within the classroom foster students' feelings of security and in turn improve students' learning behavior (Pianta, Nimetz, & Bennett, 1997; Verschueren & Koomen, 2012).

Attachment theory and several other models of social support suggest that perceptions of support from multiple and different sources may reflect a more generalized feeling that one is being cared about (Schwabe, Korthals, & Schils, 2019; Wentzel, Muenks, McNeish, & Russell, 2017). This feeling is also referred to as a sense of community (Ostermann, 2000), connectedness (Weiner, 1990), relatedness (Connell, 1990), or belonging (Goodenow, 1993). All these broad concepts refer to a feeling that individuals matter to one another and the group, and that there is a collective commitment to be together. Experiencing this feeling in the classroom has been linked to important academic outcomes such as positive attitudes toward school and academic achievement (e.g., Patrick, Anderman, & Ryan, 2002; Skinner, Furrer, Marchand, & Kindermann, 2008). Recently, Hornstra, Bakx, Mathijssen, and Denissen (2020) suggested that perceiving high-quality relationships with peers and teachers had equally strong educational benefits for high-ability students as for other students. Moreover, when high-ability students feel supported by their teacher and peers, they have a higher preference to work with others rather than individually (French, Walker, & Shore, 2011).

1.2. High-ability students' perceived relationships with peers

Although there are individual differences within the group of high-ability students (e.g., Neihart, 1999; Peairs, Putallaz, & Costanzo, 2019), peer relationships of students with high cognitive abilities are generally portrayed positively (e.g., Bain & Bell, 2004; Košir, Horvat, Aram, & Jurinec, 2016; López & Sotillo, 2009; Neihart, 2007; Robinson, 2008). As a group, high-ability students tend to be well liked and popular with peers (Neihart, 1999; Rimm, 2002). Even when high-ability students missed some class time with their regular peers — because they participated in a pull-out program focusing on creativity, social skills, and intellectual enrichment twice a week — regular peers have been found to perceive them as more socially accepted, more social competent, less aggressive, and less victimized as compared to their fellow regular peers (Cohen, Duncan, & Cohen, 1994). High-ability students may be viewed positively by their peers because characteristics that are common in popular children, including high academic success, leadership skills, few behavioral problems, and high self-esteem are more often found in individuals with a high cognitive ability (e.g., Estell et al., 2009; Frentz, Gresham, & Elliott, 1991; Jackson & Bracken, 1998). In addition, intelligence is associated with various social skills, including social perspective taking (Masden, Leung, Shore, Schneider, & Udvari, 2015), managing emotional experiences (Keiley, 2002), loyalty, moral sensitivity, and courage (Neihart, Reis, Robinson, & Moon, 2002).

However, whereas peer reports in general may not indicate disadvantageous consequences of being high-abled for relationships with peers, high-ability students themselves may perceive this differently (Kerr, Colangelo, & Gaeth, 1988; Robinson, 2008). In several studies, high-ability students expressed that they regard their cognitive ability as a source of potential difficulties for their social relationships (e.g., Cross, Frazier, Kim, & Cross, 2018; Jung, Barnett, Gross, & McCormick, 2011; Mammadov, 2019). High-ability students can feel lonely and different from their peers, even though their peers perceive them to be socially successful (e.g., Rimm, 2002; Robinson, 2002). In a notable empirical study, Vialle, Heaven, and Ciarrochi (2007) concluded that high-ability students tended to list more social supports than their peers, but at the same time felt far less satisfied with this than their peers did. Feelings of loneliness and being different may stem from special characteristics that set high-ability students apart from their peers. For example,

in Cross et al. (2018) high-income high-ability students expressed feeling alienated by peers because of a different work ethic.

Several studies have documented an increase in perceived quality of peer relationships when high-ability students are given the opportunity to interact with other high-ability students (e.g., Cross & Swiatek, 2009; Preckel, Rach, & Scherrer, 2016). For example, during summer programs aimed at high-ability students, participants experienced a stronger connection to peers and an increase in their social self-concept (Lee, Olszewski-Kubilius, Makel, & Putallaz, 2015; Preckel et al., 2016; Rinn, 2006). To date, no studies have been conducted on how high-ability students' participating in a pull-out program perceive their peer relationships. Pull-out programs carry the unique trait that participating students switch frequently between two educational settings: the pull-out program and the regular class.

One notable study on pull-out programs, although conducted over three decades ago, assessed social acceptance by peers in the regular and pull-out program through peer perceptions (Maddux, Scheiber, & Bass, 1982). Students participating in an advanced math or science program for three hours a day were rated similarly by their pull-out program peers and their regular class peers. Thus, frequently switching between two classrooms did not seem to negatively influence the way the regular peers perceived the high-ability students. Nevertheless, the study is quite outdated and focused on perceptions of peers, which may differ from perceptions of high-ability students themselves. Moreover, the study included only one measurement in both classrooms and therefore development over time could not be investigated.

Two empirical studies on summer programs provide initial clues that switching between two educational environments may have some effects on high-ability students' own perceptions of their relationships with peers (Lee et al., 2015; Makel, Lee, Olszewki-Kubilius, & Putallaz, 2012). When high-ability students participate in a summer program they have to switch between educational environments twice: at the start of the program and at the end of the program. Makel et al. (2012) and Lee et al. (2015) both followed participants prior to and after a summer program ended and thereby included both transitions. Both studies found that high-ability students felt more accepted by peers (Makel et al., 2012), experienced more acceptance and support for their high cognitive ability, felt a stronger connection to peers, and reported greater ease in forming friendships (Lee et al., 2015) *while* enrolled in the summer program as compared to *after* they left the summer program and returned to their regular classes. In addition, Makel et al. (2012) reported the remarkable finding that high-ability students' self-concept of social-acceptance became even lower than it was before participating in the summer program, with this decline being stronger for some students than for others. This latter finding seems to indicate a contrast effect in the regular class: High-ability students may have devalued the relationships with regular peers after the summer program because they had experienced what it is like to interact with like-minded peers. This same effect may be at work in students attending a pull-out program.

However, next to these initial clues for contrast effects, there are also indications for spill-over effects. More specifically, positive effects of a pull-out program may spill over to participants' regular classes. Coleman (1995), for example, suggested that when high-ability students are in a setting where they do not have to worry about stigmatization from peers or teachers, they are armed with an increased social self-concept that may have positive consequences in the regular class. Moreover, some high-ability students have mixed feelings regarding complete segregation from their peers because they value both the social diversity of regular classes and like-minded peers in special programs (Adams-Byers, Whitsell, & Moon, 2004) and feel sad about missing and losing old friends (Moon, Swift, & Shallenberger, 2002). For these high-ability students, spending time with both regular and like-minded peers may result in social benefits in the pull-out program as well as the regular class. Thus far, however, spill-over effects have rarely been examined. There is some initial evidence for spill-over effects of pull-out programs in the area of motivation, showing less of a decline in motivation for students attending a pull-out program compared to high-ability students who did not attend a pull-out program (Gubbels, Segers, & Verhoeven, 2014; Hornstra, Van der Veen, & Peetsma, 2016).

1.3. High-ability students' perceived relationships with teachers

Student-teacher relationships have received relatively little attention in the literature on high-ability students (Lee et al., 2015). This is unfortunate, as a good relationship with the teacher is highly valued by high-ability students, as well as by other students. For example, when primary school students were asked to name characteristics of a good teacher, regular as well as high-ability students mostly mentioned teacher characteristics that were associated with relatedness (Bakx, Van Houtert, Van den Brand, & Hornstra, 2019).

As a group, high-ability students have certain characteristics that have been linked to closer and less conflicted student-teacher relationships. For example, on average, high-ability students have higher academic competence (e.g., Jerome, Hamre, & Pianta, 2009; Murray & Greenberg, 2000) and superior social adjustment (e.g., Chan, 2010; Cross, Adams, Dixon, & Holland, 2004; López & Sotillo, 2009; Mueller, 2009). Yet, the literature suggests that (some) high-ability students may experience lower-quality relationships with their teachers; Adams-Byers et al. (2004), for example, found that some high-ability students felt that teachers did not recognize their cognitive ability. Instead, they felt that classmates who excelled for a short time would receive the teachers' recognition. In other studies, some high-ability students expressed that teachers were more like impediments than supporters (Cross et al., 2018) and that teachers viewed them negatively (Berlin, 2009). Studies among teachers provide some more insight into the explanations for these perceptions of high-ability students. Various studies have indicated that many regular teachers lack specific knowledge about teaching high-ability students (e.g., De Boer, Pijl, & Minnaert, 2011; Segers & Hoogeveen, 2012) and hold negative stereotyped beliefs about high-ability students (e.g., Baudson & Preckel, 2013, 2016; Matheis, Kronborg, Schmitt, & Preckel, 2017; Preckel, Baudson, Krolak-Schwerdt, & Glock, 2015). Prior research indicates that attitudes and beliefs toward groups of students (in this case, high-ability students) can affect the expectations that teachers hold toward individual students and subsequently how they behave toward them (Hornstra, Stroet, Van Eijden, Goudsblom, & Roskamp, 2018). Therefore, it is not surprising that high-ability students list "teachers' assumptions about intellectual giftedness" as one of the most negative aspects of the high-ability label (Berlin, 2009).

There are several reasons to assume that high-ability students may experience a better relationship with their teachers in the pull-out program than with their regular classroom teachers. First, teachers in pull-out programs may be better able to meet high-ability students' needs because of specific features characterizing pull-out programs. These programs are often characterized by relatively small classes (e.g., Hornstra, Van der Veen, & Peetsma, 2017). Students in smaller classes are more likely to experience one-to-one teaching (Blatchford, Bassett, & Brown, 2005), to be provided with a more personalized and appropriate curriculum (Anderson, 2000), and to have more active interactions with teachers (Blatchford, Bassett, & Brown, 2011). Another characteristic of pull-out programs is that the student population is more homogeneous than in regular classes. This could also make it easier for teachers to meet high-ability students' needs in special programs than it is to meet the highly varying needs of the heterogenous student population in regular classes (Reis & Renzulli, 2010). Second, whereas most regular teachers have received little or no specific training about high-ability students and how to meet their needs, most teachers of special programs aimed at high-ability students have received such training (De Boer, Minnaert, & Kamphof, 2013; Robinson, Shore, & Enerson, 2007). Lassig (2009) found that training can make a difference for teachers' beliefs about high-ability students as teachers who had received training about high-ability students were more likely to have favorable attitudes toward them.

There are a few initial indications that high-ability students indeed perceive their relationships with teachers as more positive in pull-out programs than in regular classes. In interviews and focus groups, high-ability students expressed that their specialized teachers were more engaged with students, treated them with more respect, had higher expectations, and offered more support than regular teachers (Hertzog, 2003; Kitsantas, Bland, & Chirinos, 2017).

To the best of our knowledge, there is only one study that examined the development of high-ability students' relationships with teachers over time (Vogl & Preckel, 2014). Vogl and Preckel compared the perceptions of these relationships between high-ability students participating in a full-time program focused on both acceleration and enrichment and a matched control group of students who were not participating in any special program but who had similar cognitive abilities, socioeconomic status, the same sex, and who attended the same school. Whereas the perceived relationships with teachers of participants in the full-time programs remained constant, the perceived relationships of students in the regular classes decreased over time. Participating in a special program thus seemed to prevent high-ability students from having a deteriorating relationship with the teacher. However, this is only initial empirical evidence and it remains unclear how student-teacher relationships are affected when students frequently switch between regular and special program teachers. Similar to relationships with peers, contrast or spill-over effects may affect high-ability students' relationships with teachers in the regular class and pull-out program.

1.4. Current study

There is a large body of literature suggesting that many high-ability students do not fully reach their cognitive potential (e.g., Morisano & Shore, 2010; Siegle & McCoach, 2018; Worrell, Subotnik, Olszewski-Kubilius, & Dixson, 2019). When high-ability students' social (or cognitive) needs are not optimally met in education, this can have negative outcomes such as disengagement with school or underachievement (Landis & Reschly, 2013). It is therefore important to learn more about factors that are associated with high-ability students' social relationships in school. Pull-out programs are an increasingly popular service and carry the unique trait that participating students switch frequently between the pull-out program and the regular class. This may have consequences for their relationships in both settings. Yet, to date, little attention has been paid to the *social* consequences of attending a pull-out program (for some exceptions see, Delcourt et al., 2007; van der Meulen et al., 2014). The current study therefore examined how participating in a pull-out program was associated with high-ability students' perceived social relationships with their peers and teachers in their regular class and pull-out program.

1.4.1. Aims

This study had two main aims. First, this study examined whether high-ability students perceived lower-quality relationships in a regular class as compared to regular students. Second, this study investigated whether a special program with like-minded peers and specialized teachers helped high-ability students to develop higher-quality relationships.

1.4.2. Hypotheses

Taken together, the literature suggests that high-ability students can perceive difficulties in their social relationships with peers and teachers (e.g., Berlin, 2009; Vialle et al., 2007) and that interaction with like-minded students and specialized teachers in a pull-out program may help high-ability students perceive more positive relationships (e.g., Lee et al., 2015; Makel et al., 2012; Vogl & Preckel, 2014). Therefore, we expected that high-ability students participating in a pull-out program would generally report (a) less positive relationships with peers and teachers in the regular class than regular students, and (b) more positive relationships in their pull-out program than in their regular class. Regarding the *development* of their perceived relationships in the pull-out program and regular class, we hypothesized two possibilities: contrast effects (i.e., perceptions of the social relationships in the regular class might become more negative compared to perceptions of the social relationships in the pull-out program) or spill-over effects (i.e., positive social experiences in the pull-out program spill over to the regular class), resulting in a similarly positive development of perceived social relationships in the regular class. There are initial clues for both possibilities (see Makel et al., 2012, for contrast effects; see Gubbels et al., 2014, for spill-over effects).

Table 1
Sample characteristics.

	Overall	High-ability students participating in a Pull-Out Program	Regular students
N (%)	674 (100%)	245 (100%)	429 (100%)
Boys	373 (55.4%)	157 (64.3%)	216 (50.3%)
Girls	300 (44.6%)	87 (35.7%)	213 (49.7%)
Grade 4	238 (35.3%)	92 (37.6%)	146 (34.0%)
Grade 5	211 (31.3%)	94 (38.4%)	117 (27.3%)
Grade 6	225 (33.4%)	59 (24.1%)	166 (38.7%)

2. Method

2.1. Participants

Participants were 674 students (44.5% girls, $M_{age} = 11.4$, $SD_{age} = 1.0$) from 31 classrooms of nine primary schools in the Netherlands. They were equally distributed among Grade 4 (35.3%), Grade 5 (31.3%), and Grade 6 (33.4%) ($\chi^2(2) = 1.62$, $p = .444$). Seventeen classes were from regular education ($n = 429$) and 14 classes were pull-out program classes ($n = 245$). Table 1 shows the grade and gender of both regular students and high-ability students participating in a pull-out program separately. Neither grade ($\chi^2(2) = 16.65$, $p < .001$) nor gender ($\chi^2(1) = 12.33$, $p < .001$) were equally distributed across groups of students. More specifically, girls and grade six students were underrepresented among high-ability students.

Available demographic information also indicated an underrepresentation of low SES and students from minoritized backgrounds in the pull-out programs, which is common for many high-ability and gifted programs (e.g., McBee, 2006; Peters & Engerrand, 2016). That is, 15.6% of the regular students were entitled to additional funding,[2] whereas only 2.9% of the high-ability students in pull-out programs were entitled to additional funding. Moreover, for most of the regular students (68.3%), one or both parents had attended higher education. But for high-ability students in the pull-out programs, this percentage was even higher (85.7%). In addition, students reported their four-digit postal code as another indicator of SES (Danesh, Gault, Semmence, Appleby, & Peto, 1999). The Dutch Social and Cultural Research Institute (SCP, 2019) has assigned a classification to each postal code in the Netherlands that indicates the social status of a neighborhood. This classification is based on its residents' educational level, income, and position on the labor market (Knol, Beeldhouwer, & Veldheer, 2012). The average neighborhood SES for the regular students was $M = 0.23$ ($SD = 1.21$) and for the high-ability students, it was $M = 0.81$ ($SD = 1.13$), indicating that the average SES of the neighborhoods of the students' in our sample was above the national average ($M = 0.00$; $SD = 1.00$), especially for the students in the pull-out programs. Finally, 21.8% of the regular students and 13.4% of the students in the pull-out programs had a non-Western minority background (versus 12.7% nationally in 2017; CBS StatLine, 2020).

2.2. Pull-out programs

Students in pull-out programs attended their regular class four days a week. For one day a week they attended one of three pull-out programs at a different school: 75.5% of the students attended a program called *Day a Week School,* 9.8% attended a program called *Intermezzo,* and 14.7% attended a program called *Doen.*

2.2.1. Selection criteria

All three programs selected high-ability students who were cognitively more advanced than their peers and who therefore had different educational needs than their classmates. At the *Day a Week School*, students were selected based on their performance on a variety of tasks that required advanced cognitive skills and creative thinking skills (see van der Meulen et al., 2014, for a more detailed description). At both *Intermezzo* and *Doen*, the students were selected based on a combination of nominations by their home school, prior performance, and a diagnostic evaluation that included an IQ test. At Doen, the IQ criterion was 115 and at Intermezzo it was 130, but deviations from these criteria were possible if the student, according to the school, could benefit from attending the pull-out program (Doen, 2014; Intermezzo, 2020). Students in the three programs did not significantly differ from each other in a group measure of cognitive abilities (Hornstra, van der Veen, & Peetsma, 2017) or in any of the four outcome measures (perceived quality of the relationship with peers/teacher in both settings) at any of the three waves (p values all > 0.05), suggesting that the three pull-out programs were attended by comparable groups of students.

2.2.2. Program characteristics

The three programs focused on in-depth activities, project-work, self-regulated learning skills, and incorporating problem-based and inquiry learning. The students were offered content and tasks beyond and often not related to the regular curriculum,

[2] Schools in the Netherlands receive additional funding for students whose parents have attained a relatively low educational level, which may be indicative of a lower SES.

including courses such as Chinese and chess. The curriculum at their regular school was compacted. This means that the high-ability students worked on the same materials as classmates, but at a faster pace. The pull-out programs were taught by specialized teachers who were trained to work with high-ability students and the classes were attended with other like-minded peers (Doen, 2014; Intermezzo, 2020; van der Meulen et al., 2014).

2.3. Procedure

Initially, regular schools and pull-out programs were randomly selected from a list of schools in the region and invited to participate in this study. Later on, additional regular schools were recruited through the participating pull-out programs as it was more difficult to find regular schools willing to participate. Prior to data collection, consent was obtained from the parents, teachers, and students.

Data were collected in the regular classes and pull-out programs during formal class time at the start, middle, and end of one school year (October, February, June). During each measurement wave, the schools were visited by a research assistant who first explained the general purpose of the study and how to fill out the questionnaire. The research assistant also explained that anonymity was guaranteed. The participants then filled out the questionnaire which started with questions on demographic information and continued with scales indicating students' perceived social relationships. The questionnaire contained additional scales not used in this study. Students attending a pull-out program filled out the questionnaire in their pull-out program for both their perceived social relationships in their regular class and in their pull-out program.

2.4. Measures

To assess students' perceived social relationships with peers and teachers, existing scales (Peetsma, Wagenaar, & De Kat, 2001) were used (see below). These scales have been used in several studies (e.g., Hornstra, van der Veen, Peetsma, & Volman, 2015; Schwabe, Korthals, & Schils, 2019; Wanders, Dijkstra, Maslowski, & van der Veen, 2020), as well as in a national representative cohort study including 20,000 participants (COOL5–18; Driessen, Mulder, Ledoux, Roeleveld, & van der Veen, 2009). Factor and reliability analyses performed on the representative cohort confirmed the construct validity and internal consistency of both scales (Driessen et al., 2009). For the purposes of this study, high-ability students in the pull-out programs filled out the scales twice at each measurement wave. They were first asked about their regular class and were thereafter presented with parallel scales about their pull-out program ("These questions refer to your regular class" or "These questions refer to [name pull-out program]"). Regular students filled out the scales once at each measurement wave (i.e., for the regular class they were in).

2.4.1. Perceived relationships with peers

Six survey items concerned students' perceived relationship with their peers (Peetsma et al., 2001). The items did not focus on specific friendships but on students' general perception of their relationship with their classmates. Students rated the extent to which each item was applicable to them (1 = *totally not applicable to me* and 5 = *totally applicable to me*). An example item is "I enjoy hanging out with my classmates". The internal consistencies of this scale were $\alpha = 0.85$, $\alpha = 0.84$, $\alpha = 0.81$ at the first, second, and third measurement wave, respectively.

2.4.2. Perceived relationships with the teacher

Seven survey items concerned students' perceived relationship with their teacher (Peetsma et al., 2001). The items focused on topics such as the way students felt around the teacher, whether the teacher understood them, and whether they felt they could talk to their teacher about personal issues. Again, students rated the extent to which each item was applicable to them (1 = *totally not applicable to me* and 5 = *totally applicable to me*). An example item is "I feel at ease with my teacher". The internal consistencies of this scale were also sufficient: $\alpha = 0.90$, $\alpha = 0.88$, $\alpha = 0.87$ at the first, second, and third measurement waves, respectively.

2.5. Data-analysis

2.5.1. Missing data

In longitudinal research, attrition of participants is a common phenomenon. In the regular education group, 17.0% of students had missing data at one measurement wave (8.9% at Wave 1; 2.6% at Wave 2; 5.6% at Wave 3), 3.0% of students missed data at two measurement waves, and 0.2% had missing data at three measurement waves. Missingness was mostly due to incidental absences at the time of data collection (e.g., due to illness). In the pull-out program group, 27.3% of students had missing data at one measurement wave (18.8% at Wave 1; 2.8% at Wave 2; 5.7% at Wave 3), 31.0% of students missed data at two measurement waves, and 4.5% had missing data at three measurement waves. Missingness occurred more frequently among pull-out program students, because it was not unusual that students enrolled in a pull-out program later on in the school year or stopped participating in the program during the school year, for example when the program did not meet students' expectations. It was also not unusual that students missed a day at the pull-out program if there was an important test or social event at their regular school. This resulted in more missing data as the questionnaires were completed in the pull-out setting.

To determine whether the missingness was completely at random, Little's tests (Little, 1988) were computed for the regular education group and the pull-out program group separately. The *p*-values were not statistically significant ($\chi^2(22) = 11.09$, $p = .973$; $\chi^2(96) = 59.89$, $p = .999$, respectively), indicating that the missing data was *Missing Completely at Random.* In this study the missing data was accounted for by the full information maximum likelihood (FIML) method.

2.5.2. Latent growth curve analyses

Multigroup and parallel latent growth curve models (Duncan, Duncan, & Strycker, 2013) were used to examine the development of high-ability and regular students' perceived social relationships with peers and teachers. For each kind of comparison (i.e., between groups of students: high-ability students in their regular class vs. regular students in their regular class, and between settings: high-ability students in their pull-out program vs. in their regular class) we performed the following procedure. First, we determined the optimal form of the growth curve by testing whether a linear or a non-linear (i.e., piecewise) model would be the best way to model the development of the perceived relationship with the teacher and the perceived relationship with peers over time. In contrast to the linear model, which assumes a linear slope from Wave 1 to 3, a piecewise model has different slopes for the first trajectory (from Wave 1 to Wave 2) and the second trajectory (from Wave 2 to Wave 3). Next, to control for grade and gender differences between high-ability students and regular students, these variables were included as covariates of the intercept and slope(s) of the perceived social relationships over the school year. Demographics were not included as covariates because of the high degree of missing values. Subsequently, we examined a series of nested models to test whether the perceived social relationships trajectories during the school year differed among the groups or between the settings. More specifically, we tested a baseline model in which all growth factors were constrained to be equal across groups or across settings. Then each of the following nested models allowed an additional growth parameter to differ between groups or settings. The order of removing equality constraints was based on the size of the modification indices, thereby removing those equality constraints that would result in the largest model fit improvement first. Using a χ^2 difference test (with Satorra-Bentler correction), we compared each nested model with the previous, more constrained model. If removing the equality constraint resulted in a statistically significant better fit over the more constrained model, the parameter was assumed to be unequal across groups or settings. In all models, the hierarchical structure of the data (students nested within classes) was taken into account by including the "type = complex" command in the Mplus syntax. In response to this command, Mplus adjusts standard errors for non-independence within classrooms. The estimator MLR was used due to non-normality of some of the variables.

In addition to the chi-square goodness-of-fit test, which is highly sensitive to sample size, we used the comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error approximation (RMSEA) to evaluate model fit. CFI and TLI values above 0.90 and RMSEA values of 0.08 or less are reflective of an acceptable fit (e.g., Hair, Black, Babin, Anderson, & Tatham, 2006).

3. Results

3.1. Assumptions

An important assumption in the application of multigroup latent growth curve models (LGCMs) is measurement invariance of the measures across groups and over time (Geiser, 2013). To assess whether the perceived social relationships constructs were invariant across groups of students, settings, and over time, we conducted confirmatory factor analyses. Using Mplus 8.2 (Muthén & Muthén, 2018), we tested increasing levels of measurement invariance against each other (i.e., a configural model with equal factor structures, a metric model with equal factor structures and loadings, and a scalar model with equal factor structures, loadings, and intercepts; Putnick & Bornstein, 2016). Measurement invariance was assumed if the more restrictive model showed only minor deteriorations in goodness of fit indices. Next to χ^2-difference tests (with Satorra-Bentler correction), we used the ΔCFI difference test to compare two models (as recommended by Chen, 2007). ΔCFI values of 0.01 and less were considered as an allowable deterioration in model fit. Initially, measurement invariance over time was not achieved for high-ability students' perceived relationships with peers in their pull-out program. The results indicated that the factor loadings and intercept of the first item of the scale ("I often interact with my classmates") differed between waves. This item appeared to reflect the frequency of interactions rather than the perceived relationship quality. Because the high-ability students spent much more time with their regular peers than with their pull-out program peers, this specific item could have a different meaning in the context of the pull-out programs. Therefore, we excluded this item for all students and both settings from all subsequent analyses and retested measurement invariance. The results indicated that, for all models, partial or scalar invariance was obtained across groups, settings, and measurement waves (see Appendices A and B; Table A, Table B1, Table B2). Therefore, it was justified to proceed with further analyses (Vandenberg & Lance, 2000). Fit of the models was acceptable to good (CFI = 0.91–0.98). The factor loadings of all items were above 0.40. Deletion of the aforementioned item still resulted in sufficient internal consistencies for the scale "Perceived relationships with peers", $\alpha = 0.82$, $\alpha = 0.81$, $\alpha = 0.85$ at the first, second, and third waves, respectively.

Table 2
Means and standard deviations of perceived social relationships of high-ability students in pull-out programs and regular classes and regular students.

Perceived relationship with	Wave	Overall	High-ability students		Regular students in regular class
			In pull-out program	In regular class	
		M (SD)	M (SD)	M (SD)	M (SD)
Peers	1	4.18 (0.73)	4.11 (0.76)	4.17 (0.81)	4.22 (0.69)
	2	4.23 (0.74)	4.26 (0.62)	4.10 (0.86)	4.27 (0.72)
	3	4.18 (0.79)	4.21 (0.67)	4.10 (0.91)	4.20 (0.78)
Teacher	1	3.81 (0.74)	3.81 (0.66)	3.82 (0.89)	3.81 (0.69)
	2	3.86 (0.74)	3.94 (0.56)	3.77 (0.88)	3.87 (0.73)
	3	3.80 (0.80)	3.91 (0.62)	3.77 (0.98)	3.76 (0.78)

Table 3
Correlations between perceived relationships at each measurement wave for all students.

Variables	1	2	3	4	5	6	7	8	9	10	11	12
Perceived relationships with … in regular class												
1. Peers 1	–	0.54***	0.45***	0.30***	0.29***	0.23***	*na*	*na*	*na*	*na*	*na*	*na*
2. Peers 2	0.72***	–	0.66***	0.33***	0.40***	0.31***	*na*	*na*	*na*	*na*	*na*	*na*
3. Peers 3	0.65***	0.76***	–	0.28***	0.41***	0.43***	*na*	*na*	*na*	*na*	*na*	*na*
4. Teacher 1	0.29***	0.16	0.27**	–	0.64***	0.49***	*na*	*na*	*na*	*na*	*na*	*na*
5. Teacher 2	0.22*	0.27**	0.25**	0.55***	–	0.64***	*na*	*na*	*na*	*na*	*na*	*na*
6. Teacher 3	0.28**	0.33***	0.44***	0.43***	0.67***	–	*na*	*na*	*na*	*na*	*na*	*na*
Perceived relationships with … in pull-out program												
7. Peers 1	0.22**	0.17	0.22*	0.10	0.24*	0.17	–	*na*	*na*	*na*	*na*	*na*
8. Peers 2	0.25**	0.28***	0.26**	0.24*	0.25**	0.24**	0.40***	–	*na*	*na*	*na*	*na*
9. Peers 3	0.20*	0.26**	0.33***	0.10	0.19*	0.23**	0.40***	0.54***	–	*na*	*na*	*na*
10. Teacher 1	0.20*	0.14	0.06	0.27***	0.16	0.03	0.42***	0.36***	0.34***	–	*na*	*na*
11. Teacher 2	−0.04	0.06	0.00	0.07	0.26**	0.09	0.35***	0.40***	0.30***	0.64***	*na*	*na*
12. Teacher 3	0.01	0.03	0.04	0.14	0.19*	0.10	0.41***	0.31***	0.44***	0.62***	0.66***	–

Note. Correlations of regular students above diagonal. Correlations of high-ability students below diagonal. *na* = not applicable. ***$p < .001$. ** $p < .01$. * $p < .05$.

3.2. Descriptive statistics

Table 2 reports the descriptive statistics of the perceived social relationships for the regular education group and for the high-ability students attending a pull-out program. Table 3 reports the correlations between the perceived social relationships at each measurement wave. On average, both groups of students reported rather positive perceptions of their relationships with their peers and teachers (all 3.77 or higher on a five-point scale). Further, the variability in high-ability students' perceived social relationships in the regular class was relatively high (*SD*s ranging from 0.81 to 0.91) as compared to the variability in their perceived social relationships in the pull-out programs (*SD*s ranging from 0.56 to 0.76) and compared with regular students in the regular class (*SD*s ranging from 0.69 to 0.78).

3.3. Perceived relationships with peers

3.3.1. Comparison between groups of students

First, developments in high-ability students' and regular students' perceived relationships in the regular class were modeled. A linear growth model provided better model fit than a piecewise growth model, linear: $\chi^2(1) = 3.35$, $p = .067$, CFI = 0.99, TLI = 0.98, RMSEA = 0.06, 90% CI [0.00, 0.15]; piecewise: $\chi^2(2) = 24.84$, $p < .001$, CFI = 0.93, TLI = 0.90, RMSEA = 0.13, 90% CI [0.09, 0.18]. Neither gender nor grade were related to the initial level of perceived relationship with regular peers or its development thereafter ($p > .05$). Therefore, both covariates were excluded from the model.

Multigroup analysis revealed that the initial perceived relationships with regular peers did not differ in a statistically significant way between high-ability students and regular students; allowing the intercept to differ between the two groups did not result in a better model fit ($\Delta\chi^2(1) = 3.23$, $p = .072$). On average, both high-ability students and regular students rated their relationship with peers 4.22 at the start of the school year (on a five-point scale). The slope ($\Delta\chi^2(1) = 0.85$, $p = .357$) of perceived relationships with regular peers was also equivalent for high-ability students and regular students, showing that perceived relationships with regular peers did not change over the school year. Table 4 presents the final growth factors for the development of perceived relationships with regular peers per group of students.

3.3.2. Comparison between settings

Second, developments in high-ability students' perceived relationships with peers in both their regular class and their pull-out program were modeled. A linear growth model provided better model fit than a piecewise growth model, linear: $\chi^2(1) = 0.87$, $p = .351$, CFI = 1.00, TLI = 1.00, RMSEA = 0.00, 90% CI [0.00, 0.12]; piece-wise: $\chi^2(2) = 6.69$, $p = .035$, CFI = 1.00, TLI = 0.99, RMSEA = 0.07, 90% CI [0.02, 0.13]. Because the peer relationships of the same students were compared across settings, gender and grade were distributed equally and not included as covariates.

Parallel analysis revealed that the intercept did not differ between the two settings, as allowing the intercepts to differ between the settings did not result in a better model fit ($\Delta\chi^2(1) = 0.01$, $p = .939$). This indicates that high-ability students' perceived relationships with peers at the start of the school year did not differ in a statistically significant way in their regular class and their pull-out program. On average, high-ability students rated their relationship with peers 4.16 at the start of the school year. However, the slope ($\Delta\chi^2(1) = 7.77$, $p = .005$) of perceived relationships with peers differed for high-ability students in their regular class and their pull-out program. Whereas the perceived relationships with peers in the pull-out setting became more positive over time ($b = 0.03$, $p = .266$), the perceived relationships with peers in the regular class became more negative ($b = -0.05$, $p = .157$). Although both slopes were not statistically significant on their own, they differed from each other in a statistically significant way. To give an impression of the size of this difference, the effect size for the difference in the observed mean scores at Wave 3 was calculated. This effect size was Cohen's $d = 0.14$, which represents a small effect size. Table 5 presents the final growth factors for the development of high-ability students' perceived relationships with peers in both settings. Fig. 1 displays the trajectories in both the regular class and pull-out program.

Table 4
(Constrained) Growth factors for development of perceived relationships with peers.

	Intercept	Slope
	Mean (SE)	Mean (SE)
High-ability students in regular class	4.22 (0.02)	−0.02 (0.02)
Regular students in regular class	4.22 (0.02)	−0.02 (0.02)

Table 5
(Constrained) Growth factors for development of perceived relationships with peers.

	Intercept	Slope
	Mean (SE)	Mean (SE)
High-ability students in pull-out program	4.16 (0.04)	0.03 (0.02)
High-ability students in regular class	4.16 (0.04)	−0.05 (0.03)

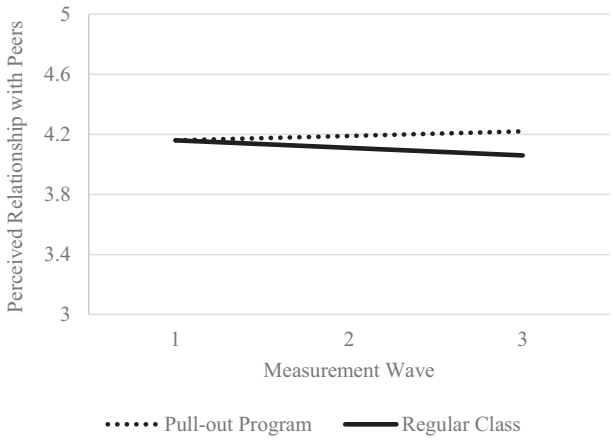

Fig. 1. Linear developments in high-ability students' perceived relationship with peers in their pull-out program and regular class.

Table 6
(Constrained) Growth factors for development of perceived relationships with the teacher.

	Intercept	Slope
	Mean (SE)	Mean (SE)
High-ability students in regular class	3.82 (0.04)	−0.02 (0.03)
Regular students in regular class	3.82 (0.04)	−0.02 (0.03)

3.4. Perceived relationships with the teacher

3.4.1. Comparison between groups of students

Third, developments in high-ability students' and regular students' perceived relationship with the regular teacher over the school year were modeled. A linear growth model provided better model fit than a piecewise growth model, linear: $\chi^2(1) = 4.43$, $p = .035$, CFI = 1.00, TLI = 0.99, RMSEA = 0.07, 90% CI [0.02, 0.15]; piecewise: $\chi^2(2) = 23.54$, $p < .001$, CFI = 0.97, TLI = 0.95, RMSEA = 0.13, 90% CI [0.08, 0.18]. Neither grade nor gender were related to the initial level of perceived relationship with the teacher or its development thereafter ($p > .05$). Both were excluded from the model.

Multigroup analysis did not reveal group differences for the intercept mean ($\Delta\chi^2(1) = 0.07$, $p = .788$) or the slope mean ($\Delta\chi^2(1) = 0.01$, $p = .908$) of the development of the perceived relationship with the regular teacher. On average, both high-ability and regular students rated their relationship with the teacher as 3.82 at the start of the school year and there was no statistically significant change in the perceived relationship across the school year. Table 6 presents the final growth factors for the development of perceived relationships with the regular teacher per group of students.

3.4.2. Comparison between settings

Fourth, developments in high-ability students' perceived relationship with the teacher of their regular class and their pull-out program were modeled. A linear growth model provided a better model fit than a piece wise growth model, linear: $\chi^2(1) = 1.47$, $p = .226$, CFI = 1.00, TLI = 0.99, RMSEA = 0.03, 90% CI [0.00, 0.13]; piecewise: $\chi^2(2) = 5.29$, $p = .071$, CFI = 0.96, TLI = 0.95, RMSEA = 0.06, 90% CI [0.00, 0.12]. Because the teacher relationships of the same students were compared across settings, gender and grade were distributed equally and not included as covariates.

Parallel analysis did not reveal any setting differences for intercept mean ($\Delta\chi^2(1) = 1.61$, $p = .204$) or slope mean ($\Delta\chi^2(1) = 0.55$, $p = .460$). This indicates that both the initial state of perceived relationships with the teacher and their growth trajectories did not differ substantially for high-ability students in their regular class and pull-out program. On average, high-ability students rated their relationship with the teacher as 3.83 at the start of the school year and this score did not change in a statistically significant way over time. Table 7 presents the final growth factors for the development of high-ability students' perceived relationships with the teacher in both settings.

Table 7
(Constrained) Growth factors for development of perceived relationships with the teacher.

	Intercept	Slope
	Mean (SE)	Mean (SE)
High-ability students in pull-out program	3.83 (0.05)	0.02 (0.02)
High-ability students in regular class	3.83 (0.05)	0.02 (0.02)

4. Discussion

Most studies on pull-out programs have focused on academic outcomes and indicated that these programs generally had positive effects on high-ability students' academic achievement (e.g., Hoogeveen et al., 2004; Vaughn et al., 1991). Relatively few studies focused on the social relationships of students attending these programs (Delcourt et al., 2007; van der Meulen et al., 2014). The current longitudinal study aimed to gain more insight into high-ability students' perceived relationships with their teacher and peers in their regular class and compared them with (a) the perceived relationships of regular students in the regular class and (b) their perceived relationships in their pull-out program. Our results indicate that high-ability students did not perceive their social relationships with peers and teachers more negatively than regular students. Both groups experienced their social relationships with their regular peers and teachers to be positive. There was only a small difference between high-ability students' perceived relationships with their pull-out program peers and their regular peers, as the development of the latter was slightly more negative over time, indicating a contrast effect. Altogether, these findings raise the question of whether or not high-ability students have a commonly shared need for interaction with like-minded peers and specialized teachers in a special program to experience positive social relationships, or whether this differs between different high-ability students. The results are discussed in more detail below.

4.1. Comparisons between groups of students

In general, high-ability students, similar to their regular peers, perceived their relationships with regular peers and teachers as rather positive. This finding contrasts with prior literature suggesting that high-ability students typically feel misunderstood and unappreciated by their peers and teachers in regular classes (e.g., Adams-Byers et al., 2004; Berlin, 2009; Robinson, 2002). Instead, the results suggest that high-ability students' perceptions actually coincide more with how others perceive them, as socially able and well liked (e.g., Neihart, 1999; Rimm, 2002). A possible explanation for this finding is that feelings of being different and misunderstood may apply to a select group of high-ability students only. High-ability students form a diverse group with some individuals being more likely to experience social difficulties in the regular classroom than others (e.g., Neihart, 1999; Reis & Renzulli, 2009). For example, students who show extremely high ability in the verbal domain have been found to experience more social difficulties than other students (e.g., Dauber & Benbow, 1990; Lee, Olszewski-Kubilius, & Thomson, 2012). It is possible that our study did not identify these extreme cases because of the quantitative and large-scale character and the fact that we did not make a distinction between subpopulations. The finding that there was higher variability in perceived social relationships among high-ability students in the regular class than in the pull-out program, as well as compared to regular students, makes the plausibility of this explanation even greater. Moreover, when Peairs, Putallaz, & Costanzo, 2019 accounted for the heterogeneity of high-ability students' social experiences by examining both ends of the popularity status continuum, they presented a remarkable finding: high-ability students at the lower end of this status continuum were more vulnerable to victimization than regular students at this lower end, although high-ability students in general had a similar social status compared to regular students in general. Still, it is interesting that the present study's high-ability students who spent one day a week away from their regular classroom did not generally experience lower-quality relationships with their regular-classroom peers and teacher than children who did not miss any time in that classroom. The aforementioned positive social characteristics of high-ability students as a group, such as high academic success, leadership skills, few behavior problems, and high self-esteem (e.g., Estell et al., 2009; Frentz et al., 1991; Jackson & Bracken, 1998) may have compensated for the fact that they spent less time in the regular class than others. It could also be that missing only one day per week does not diminish the perceived quality of social relationships in comparison with regular peers, as high-ability students still spend most of the schooldays with them.

4.2. Comparisons between settings

At the start of the school year, high-ability students' perceived peer relationships were similar in the regular class and pull-out program. However, as the school year progressed, perceptions of peer relationships in the two settings began to differ slightly, with a negative trend in the regular class and a positive trend in the pull-out program. This finding should be put into perspective as the effect size for the difference in trends was only small, both trends were not statistically significant in themselves, and the perceived relationships in both settings were still rather positive. Still, for some students, this trend may be quite strong and if this trend were to continue over a longer period of time and become more pronounced, it may point toward a contrast effect. That is, (some) high-ability students may devalue their relationships with regular peers after experiencing what it is like to interact with like-minded peers in a pull-out program. It may be that participation in a pull-out program enhances feelings of differentness toward peers in the regular class. More specifically, students who participate in a pull-out program, which is only accessible for a small group of highly able students, may therefore feel "very intelligent" in comparison to their regular peers. As this differentness is pointed out every week when the student is attending the pull-out program and then returns to the regular class, the feelings of differentness in the regular class may also become apparent every week. Alternatively, it may be that students in pull-out programs miss certain social events that others in the regular class experience together. This may cause some high-ability students to feel increasingly alienated from regular peers over time. Note that this finding may not necessarily be specific to high-ability students, as they are not the only ones who regularly switch classes during the school week. It may well be that other students who take part of their lessons outside their regular class (e.g., remedial classes) also experience changes in the relationships with peers in their regular class.

The finding that high-ability students in general perceived positive and similar relationships with their regular and pull-out program teachers does not correspond with previous studies indicating that high-ability students have better relationships with their special program teachers than with their regular teachers (e.g., Hertzog, 2003; Kitsantas et al., 2017; Vogl & Preckel, 2014). Even

though the regular teachers in this study taught in larger and more heterogeneous classrooms, they still achieved equally positive relationships with high-ability students compared to the pull-out program teachers. There are several possible explanations for this finding. High-ability students spend the most time in their regular class with their regular teacher, which may foster the quality of their relationship and counterbalance the potential benefits of the specific expertise of the pull-out program teachers with high-ability students. Another explanation may be that regular teachers have become more aware of the specific educational needs of high-ability students, as the amount of attention paid to high-ability students is increasing in the Netherlands (De Boer et al., 2013). Finally, it cannot be ruled out that spill-over effects caused the positive perceptions of the relationships with the teacher in the regular class. That is, the fact that high-ability students spent one day of the week with a special program teacher who understood them may have had a positive impact on their relationships with regular teachers as well.

4.3. Limitations and future research

This study had some limitations that need to be noted. First, the selection criteria of the pull-out programs were diverse. As a result, the frequently made statement that high-ability students form a diverse group of students (e.g., Neihart, 1999; Reis & Renzulli, 2009) also applies to the high-ability students in this study. However, the high-ability students shared a great commonality as they were taken out of their class for a portion of the week to attend a special program because their cognitive capacity stood out. Second, the selection of regular schools was not completely random but took place partly through connections with pull-out programs. This may have resulted in a sample of regular schools with a stronger focus on high-ability students than typical regular schools. For that reason, the results may not be fully generalizable to typical regular schools. Nevertheless, high-ability students still were more likely to meet like-minded peers and teachers with more specific knowledge on how to meet their needs in their pull-out programs than in their regular classes. Third, information on how long high-ability students attended their pull-out program was not available. In addition, the students were not followed before or at entry into the pull-out program. As a consequence, we were unable to study their relationship formation with like-minded and specialized teachers from the start. Nonetheless, by comparing two settings, this study demonstrated that longer participation in a pull-out program was associated with somewhat more negative perceptions of peer relationships in the regular class in comparison to the peer relationships in the pull-out program. Future research could compare high-ability students' perceived social relationships in the regular class prior to and after entering a pull-out program to gain further understanding of how attendance of a pull-out program may affect social relationships in the regular class. This could help to show whether the high-ability students in the present study already experienced positive social relationships in the regular class prior to entering the program, or alternatively, whether they perceived these relationships more poorly before attending the program. That is, attendance in the pull-out program may have raised students' confidence or social skills and this may have contributed to improved social relationships in the regular class. A pretest-posttest design could clarify this association.

This study raised some other questions for future research as well. First, the most prevailing question is whether or not the negative trend in the regular classes might persist. A similar study over a longer time period could answer this question. Second, if the contrast effect indeed persists, it would be very interesting to examine the weights that high-ability students assign to their perceived relationships in the pull-out program and the regular class for their overall well-being. Although these students spend the most amount of time in their regular class, this does not necessarily mean that this setting has the largest impact on their overall well-being. Third, heterogeneity within the population could be taken into account, as this study found high variability in perceived relationships among high-ability students. Fourth, in this study, high-ability students switched between their regular class and pull-out program once a week. Some pull-out programs, however, take place several times a week and therefore students switch classes more often. Future research could investigate whether the frequency of switching between the two contexts plays a role in the effects on relationships with peers and teachers.

4.4. Conclusions and implications

This study has contributed to research on the social relationships of high-ability students participating in a pull-out program. To our knowledge, this study was the first to examine high-ability students' *own* perceptions of relationships with peers and teachers in *both* their regular class and pull-out program *over time*. Our finding that high-ability students also generally perceive their relationships to be positive in their regular class suggests that high-ability students, in general, are not in need of interaction with like-minded peers and specialized teachers to experience positive social relationships. The findings of this study furthermore suggest that participation in a pull-out program may, in the long run, have negative effects on perceived peer relationships in the regular class. Future research is necessary to learn more about this potential contrast effect as well as the individual differences among high-ability students.

Our study presents evidence to educators and school psychologists that pull-out programs may not only have academic effects but also social effects. These programs may also not only affect high-ability students in the context of the program, but can also impact them in the regular class. It is therefore important for educators and school psychologists to closely consider and monitor the academic *and* the social effects of attending a pull-out program in both settings. The findings also imply that there may be individual differences. Whereas some students may be in need of a pull-out program or another special service, others may be served adequately in a regular classroom. Next to individual student characteristics, this may depend on contextual factors (e.g., the training of a regular teacher in differentiated instruction). School psychologists and educators thus would want to assess both the environment and student characteristics in making recommendations for attending pull-out programs. Adopting a personalized and holistic approach fitted to the specific needs of individual students, such as multi-tiered systems of support (MTSS; Gamm et al., 2012), could help educators and school psychologists to provide all students, including high-ability students and their classmates, with the support to flourish both

academically and socially.

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Appendix A. Measurement invariance across groups

Table A
Tests for measurement invariance of the scales *across groups* with Satorra-Bentler correction in χ^2-difference testing for MLR estimator.

Model	χ^2	*df*	*p*	CFI	Comparison	$\Delta\chi^2$	Δdf	Δp	ΔCFI
Between groups of students									
Configural	148.78	104	0.003	0.98					
Metric	156.61	114	0.005	0.98	2 vs. 1	8.40	10	0.590	0.00
Partial Scalar	168.94	122	0.003	0.98	3 vs. 2	12.68	8	0.123	0.00
Between settings									
Configural	149.30	104	0.002	0.97					
Metric	162.33	114	0.002	0.97	2 vs. 1	13.08	10	0.219	0.00
Partial Scalar	176.85	122	0.001	0.96	3 vs. 2	15.10	8	0.057	0.01

Note. df = degrees of freedom; *CFI* = comparative fit index; Between groups of students = High-ability students in regular class versus regular students in regular class; Between settings = High-ability students in pull-out program versus high-ability students in regular class.

Appendix B. Measurement invariance over time

Table B1
Tests for measurement invariance of the scale "Perceived Relationships with Peers" *over time* with Satorra-Bentler correction in χ^2-difference testing for MLR estimator.

Model	χ^2	*df*	*p*	CFI	Comparison	$\Delta\chi^2$	Δdf	Δp	ΔCFI
Regular students									
Configural	160.56	72	<0.001	0.95					
Metric	164.87	80	<0.001	0.95	2 vs. 1	3.30	8	0.914	0.00
Partial Scalar	170.63	84	<0.001	0.95	3 vs. 2	5.09	4	0.278	0.00
High-ability students in regular class									
Configural	114.87	72	0.001	0.96					
Metric	119.16	80	0.003	0.97	2 vs. 1	5.96	8	0.651	0.01
Partial Scalar	128.99	86	0.002	0.96	3 vs. 2	9.97	6	0.126	0.01
High-ability students in pull-out program									
Configural	93.02	72	0.049	0.97					
Metric	108.28	80	0.019	0.95	2 vs. 1	15.49	8	0.050	0.02
Scalar	112.43	88	0.041	0.96	3 vs. 2	3.20	8	0.921	0.01

Note. df = degrees of freedom; *CFI* = comparative fit index.

Table B2
Tests for measurement invariance of the scale "Perceived Relationships with the Teacher" *over time* with Satorra-Bentler correction in χ^2-difference testing for MLR estimator.

Model	χ^2	*df*	*p*	CFI	Comparison	$\Delta\chi^2$	Δdf	Δp	ΔCFI
Regular students									
Configural	315.01	162	<0.001	0.96					
Metric	319.17	174	<0.001	0.96	2 vs. 1	4.14	12	0.981	0.00
Partial Scalar	333.98	182	<0.001	0.96	3 vs. 2	14.83	8	0.062	0.00
High-ability students in regular class									
Configural	246.45	162	<0.001	0.96					
Metric	262.81	174	<0.001	0.96	2 vs. 1	16.20	12	0.182	0.00
Partial Scalar	273.53	182	<0.001	0.96	3 vs. 2	10.56	8	0.228	0.00
High-ability students in pull-out program									
Configural	298.70	162	<0.001	0.91					
Metric	305.08	174	<0.001	0.91	2 vs. 1	6.90	12	0.864	0.00
Scalar	319.99	184	<0.001	0.91	3 vs. 2	14.75	10	0.141	0.00

Note. df = degrees of freedom; *CFI* = comparative fit index.

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