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Effortful control, task persistence, and reading skills☆

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ABSTRACT

The present study aimed to explore the shared and unique variance of children's effortful control and task persistence as rated by mothers and language teachers, and to investigate their associations with reading skills. Overall, 732 sixth-grade children (52% boys) from 57 classes participated in the study. Bifactor models fit the data best, showing that effortful control and task persistence, as measured by widely-used questionnaires, have not only a great amount of shared variance which is explained by the common Effortful-Control factor, but also some unique variance explained by specific factors. The parent- and teacher-rated common Effortful-Control factor and unique Task-Persistence factor were both positively associated with reading skills. In contrast, the Inhibitory-Control-specific factor was negatively associated with reading skills. The results suggest that latent variables, rather than composite scores, should be used when employing questionnaires to measure these constructs.

1. Introduction

Regulating one's behavior is an important characteristic of learning behavior (Zimmerman, 2002). Self-regulation has been studied via effortful control (EC), which is a multifaceted construct that includes the ability to focus attention and to activate and inhibit behavior when necessary (Bridgett, Oddi, Laake, Murdock, & Bachmann, 2013). Persistence on challenging tasks has been considered an indication of attentional control and the ability to regulate emotional and behavioral impulses (Eisenberg et al., 2005; Eisenberg, Spinrad, & Eggum, 2010). Moreover, task persistence (TP; also referred to as task-focused versus task-avoidant behavior) has also been explained in motivational theories and linked to motivational beliefs and strategies (Onatsu-Arvilommi & Nurmi, 2000; Zhang, Nurmi, Kiuru, Lerkkanen, & Aunola, 2011). Repeated failures may lead to a sense of low self-efficacy (Bandura, 1997) or helplessness (Diener & Dweck, 1978), which may in turn cause students to give up on a challenging task (Bandura, 1997; Diener & Dweck, 1978). Growing empirical evidence points to a positive link between academic achievement and both EC (e.g., Blair & Razza, 2007; Véronneau, Hiatt Racer, Fosco, & Dishion, 2014; Zhou, Main, & Wang, 2010) and task-persistent learning behavior (or a negative link between academic achievement and task avoidance; e.g., Georgiou, Manolitsis, Zhang, Parrila, & Nurmi, 2013; Hirvonen, Georgiou, Lerkkanen, Aunola, & Nurmi, 2009; Jõgi & Kikas, 2016; Kikas & Mägi, 2015; Metsapelto et al., 2015). Although EC and TP have similar underlying psychological processes (e.g., attentional control), these constructs have been explored and studied independently. Knowledge about EC or TP and their specifics in each student may help teachers support students' self-regulation skills and motivation, enabling them to be more successful in their learning.

Thus far, little research has been carried out in older grades compared to younger grades (for exceptions, see Andersson & Bergman, 2011; Kikas & Mägi, 2015; Silinskas & Kikas, 2017; Véronneau et al., 2014). However, self-regulating one's learning behavior (EC and TP in school) may become especially important at the onset of adolescence in middle school, when academic expectations increase in complexity and students get less help from parents and spend more time with friends (Eccles & Roeser, 2005; Mahatmya, Lohman, Matjasko, & Farb, 2012; Steinberg & Monahan, 2007). In general, middle school is characterized by decreased academic motivation and engagement in learning (Anderman & Maehr, 1994; Mahatmya et al., 2012).

This study aimed to integrate self-regulation and motivational approaches in an effort to examine EC and TP simultaneously. We studied middle school students (Grade 6) in Estonia. Estonian students have shown good academic knowledge in international comparative surveys such as the Program for International Student Assessment PISA (e.g., in 2015, Estonia placed third in science, sixth in reading, and ninth in math; OECD, 2016). However, many students in middle school face

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increased challenges. National-level tests are carried out in the end of Grade 6, and students are prepared specifically for these tests. Additionally, there is a high homework load in Estonian schools. According to the 2014 OECD report, 15-year-old students in Estonia spend more than six hours per week on homework assignments (OECD, 2014), which was among the highest for all OECD member countries.

1.1. Effortful control

The construct of EC emerged from research on temperament and is defined as "constitutionally-based individual differences in emotional, motor, and attentional reactivity and self-regulation" (Rothbart & Bates, 2006, p. 100). EC refers to voluntary control over the approach (activation) or withdrawal (inhibition) of behavioral tendencies via attentional (shifting and focusing) and inhibitory control mechanisms (Bridgett et al., 2013; Eisenberg et al., 2010; Lengua, Bush, Long, Trancik, & Kovacs, 2008; Rothbart & Bates, 2006). As Muris, Mayer, van Lint, and Hofman (2008) describe, one of the most important aspects of EC is the skilled control of higher-order executive attention that plays a role in the regulation of emotional responses and associated behaviors. This aspect of self-regulation is associated with academic adjustment and functioning (Blair, Calkins, & Kopp, 2010), including achievement and engagement in school (e.g., Blair & Razza, 2007; Deater-Deckard, Mullineaux, Petrill, & Thompson, 2009; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008). Effortful control becomes especially important in early adolescence, when children must cope with the physical, emotional, and social changes that go along with puberty in addition to higher demands at school (e.g., different teachers for each subject, building new skills on top of foundational skills, etc.; Eccles & Roeser, 2005). Therefore, the capacity for self-regulation expands during childhood and throughout adolescence (Monahan, Steinberg, & Cauffman, 2009; Roberts, Caspi, & Moffitt, 2001; Steinberg et al., 2008).

Self-reports (Snyder et al., 2015; Véronneau et al., 2014; Wang, Brinkworth, & Eccles, 2013), parental ratings (Blair & Razza, 2007; Deater-Deckard et al., 2009; Véronneau et al., 2014), and/or teacher ratings (Blair & Razza, 2007; Véronneau et al., 2014) have often been used to assess children's temperament-based EC. The measures of EC, including the widely-used EC subscale of the *Early Adolescent Temperament Questionnaire–Revised* (EATQ-R) (Ellis & Rothbart, 2001), have identified three primary dimensions: inhibitory control (willful inhibition or planning of behavior), attentional focusing (willful maintenance of attentional focus), and attentional shifting or activation control (willful shifting of attention to deal with task demands) (Eisenberg et al., 2001). These dimensions are highly intercorrelated and expected to load onto a single EC factor (e.g., Rothbart, Ahadi, Hershey, & Fisher, 2001). However, Snyder et al. (2015) showed recently that, although these three dimensions together account for the greatest variance in the EATQ-R as measured by adolescent self-reported EC, a factor specific to activation control needs to be considered as well, supporting the view of EC as a multifaceted construct. Although bifactor models are widely used to test multifaceted constructs (Chen, West, & Sousa, 2006), the structure of parent- and teacher-rated EC questionnaires has not been explored in a similar manner.

A growing body of literature reveals that EC predicts academic success in children and adolescents, even after controlling for prior academic performance and general cognitive ability (Allan & Lonigan, 2011; Blair & Razza, 2007; Checa & Rueda, 2011; Valiente et al., 2008; Zhou et al., 2010). For instance, Checa and Rueda (2011) found that parent-rated EC predicted childhood literacy rates, even after considering the effect of general intelligence.

1.2. Task persistence

The construct of TP reflects a child's capacity to engage consistently in challenging tasks without losing focus or becoming irritable in the presence of internal and external distractions (Drake, Belsky, & Fearon, 2014). Rothbart and Hwang (2007) proposed that the ability to persist during challenging tasks is an important indicator of child's EC. Some studies have used the duration a child persists on a challenging task (e.g., the Puzzle Box Task; Eisenberg et al., 2001, 2005) as an index of the child's temperament-based EC (Zhou et al., 2007). However, task-persistent versus task-avoidant behavior may reflect not only a child's attentional and inhibitory control mechanisms, but also their motivational beliefs and strategies. First, task-avoidant behavior may develop when the child experiences repeated failures, which may decrease his/her self-efficacy (Bandura, 1997) or increase feelings of helplessness (Diener & Dweck, 1978). Second, students may also actively avoid challenging tasks because they might believe that trying hard and failing at a task indicates their low ability (Covington, 1984). Low effort, therefore, can serve as a buffer against negative feedback in the case of failure (Zhang et al., 2011). Unfortunately, such task-avoidant behavior can also restrict important opportunities to learn.

Research in the motivational field has widely used the Behavioral Strategy Rating scale (BSRS; Onatsu & Nurmi, 1995; Zhang et al., 2011) to measure children's task-persistent versus task-avoidant behavior in various learning contexts. Teacher ratings have been primarily used to assess children's TP in classroom (Georgiou et al., 2013; Hirvonen et al., 2009; Kikas & Mägi, 2015; Zhang et al., 2011). Fewer studies have used parent ratings to measure children's TP during homework (Mägi, Lerkkanen, Poikkeus, Rasku-Puttonen, & Nurmi, 2011; Silinskas & Kikas, 2017). Although motivational factors are important in self-regulating one's behavior and exerting effort in challenging tasks (Elliot & Thrash, 2002, 2010), low persistence due to maladaptive motivational beliefs and helplessness is not easily differentiated from low persistence due to other factors (e.g., individual differences in temperament and executive functions) when parent and teacher reports of task-persistent versus task-avoidant behavior are used. For example, it has been shown that, irrespective of academic performance, a low level of empathy and high levels of both impulsivity and disruptiveness in kindergarten seem to contribute to future teacher ratings of high task avoidance (Mägi et al., 2013). This suggests that issues other than low feelings of self-efficacy and high feelings of helplessness are involved in the development of low TP. Hence, the focus of this study was to investigate differences between TP and EC, as measured by parent and teacher ratings.

Earlier studies have consistently shown positive associations between TP and academic performance (Aunola, Leskinen, Lerkkanen, & Nurmi, 2004; Hirvonen, Tolvanen, Aunola, & Nurmi, 2012), including reading skills (Aunola, Nurmi, Niemi, Lerkkanen, & Rasku-Puttonen, 2002; Georgiou et al., 2013; Hirvonen et al., 2009; Kikas & Mägi, 2015; Kikas, Peets, & Hodges, 2014; Metsapelto et al., 2015; Mägi, Häidkind, & Kikas, 2010). However, low TP is not always associated with low skill development, and vice versa (Mägi et al., 2013). It has also been argued and demonstrated that the effects of self-regulation mechanisms on skill development may depend on the complexity of the skill. Georgiou, Manolitsis, Nurmi, and Parrila (2010) and Georgiou et al. (2013) found that teacher-rated TP is a stronger predictor of spelling skills and reading comprehension as compared to reading fluency. Similarly, when studying variations in self-regulation profile groups, Mägi, Männamaa, and Kikas (2016) found greater differences in reading comprehension as compared to reading fluency and math skills. While earlier studies have primarily examined the relationship between TP and academic skills in elementary school (with the exceptions of fourth grade (see Liao, Georgiou, Zhang, & Nurmi, 2013; Metsapelto et al., 2015) and sixth grade (see Kikas & Mägi, 2015; Silinskas & Kikas, 2017), TP might be especially important for academic success in middle school, where tasks become more complex and learning is based on knowledge and preliminary skills acquired in earlier years. If these foundational skills are not sufficient, more-demanding tasks in middle school can lead to considerable challenges.

1.3. Aims and hypotheses

Self-regulation skills are responsible for directing and controlling attention, thoughts, emotions, and actions (McClelland & Cameron, 2012), and they are considered a multidimensional construct with interrelated cognitive, emotional, and behavioral components (Liew, 2012; McClelland & Cameron, 2012). The behavioral components of self-regulation have often been explored in terms of temperament-based EC (McClelland & Cameron, 2012; Rueda, Checa, & Rothbart, 2010). TP is considered an important indicator of a child's EC (Rothbart & Hwang, 2007), and is thought to be most relevant in academic contexts where children need to inhibit or activate motivation- and emotion-driven behavioral responses according to teachers' instructional demands and learning tasks. Hence, EC and TP can both be considered behavioral aspects of self-regulation that have historically been studied from different theoretical perspectives (McClelland & Cameron, 2012; Rueda et al., 2010). Thus, this study aimed to examine the overlap between these two constructs through the use of teacher and parent reports.

Namely, we explored the shared and specific variances of children's EC and TP in early adolescence. We employed two widely-used questionnaires: the *Effortful Control Subscale of Early Adolescent Temperament Questionnaire–Revised* (EATQ-R; Ellis & Rothbart, 2001); and the *Behavioral Strategy Rating Scale* (BSRS; Onatsu & Nurmi, 1995; Zhang et al., 2011). We used both parent and teacher ratings in order to account for different learning contexts (for EC, see Blair & Razza, 2007; Zhou et al., 2010; for TP, see Mägi et al., 2011; Zhang et al., 2011). We chose to use only maternal reports because mothers are often more involved in helping children with homework compared to fathers (Hoffert, Pleck, Stueve, Bianchi, & Sayer, 2002; Kikas, Tulviste, & Peets, 2014), thus it follows that mothers have more opportunities to observe their child's behavior while completing homework.

We expected the three subscales of the EATQ-R (attentional focusing, activation control, and inhibitory control) that measure EC to share a great amount of common variance while showing a significant amount of unique variance (Snyder et al., 2015), thereby reflecting the multifaceted nature of the EC construct. In addition, we expected TP to share a considerable amount of variance with the common EC factor (Rothbart & Hwang, 2007) while also having a significant amount of unique variance. We hypothesized that the shared variance between EC and TP would be greater for teachers' ratings, because teachers see children mainly in academic contexts with high self-regulatory demands, and their ratings are based on children's behavior in those particular settings (Frick, Barry, & Kamphaus, 2010; Zhang et al., 2011). Home environments, by contrast, are generally less structured and more flexible; therefore, a greater repertoire of behaviors in a variety of contexts may be observed by parents.

Both EC (Allan & Lonigan, 2011; Checa & Rueda, 2011) and TP (Georgiou et al., 2010; Georgiou et al., 2013; Hirvonen et al., 2009) have consistently been shown to have positive associations with children's reading skills. To the best of our knowledge, no studies have investigated the associations between common and unique aspects of the EC and TP constructs, and reading fluency and reading comprehension skills. We expected reading comprehension (as compared to reading fluency) would have significant positive associations with the common EC factor (Georgiou et al., 2010; Mägi et al., 2016). We also expected the associations in teacher reports to be stronger than those in parent reports (Rudasill et al., 2014), since teachers observe students when they are completing reading tasks, thus allowing them to compare learning behaviors of different students in one classroom.

2. Method

2.1. Participants

A total of 732 sixth-grade children (52% boys) from 57 classes participated in the study. This study was a part of a longitudinal "Kindergarten-School Study" that followed children's development and academic achievement from kindergarten (6 to 7 years old) until the end of Grade 9 (15 to 16 years olds). Children's EC was assessed only once, in the sixth grade. The schools were selected from different parts of Estonia in both urban and rural areas. These were mainstream schools attended by local children. Ability grouping was not used within or across the classrooms. Children came from families where 13% of the mothers and 12% of the fathers had a basic education or less (nine years of formal education), 62% of the mothers and 65% of the fathers had a secondary education (high school, Grades 10–12), and 25% of the mothers and 23% of the fathers had a college or university education.

All children studied in mainstream classes following the National Curriculum for Basic Schools (Estonian Government, 2011/2014). Three to 27 students participated from each classroom. All classes were taught in Estonian, the native language of all participants. Overall, 57 Estonian language teachers, as well as and mothers of 604 children, participated in the study (participation rate was 67%).

2.2. Procedure

The first agreement to participate in the study was obtained from school principals when the participant children started Grade 1. The principals informed the teachers, who in turn asked the parents for informed consent. At first, all students with parental permission were included in the study (53 classes). As some schools were only elementary schools (up to Grade 4), several changes in classroom composition took place between Grade 1 and Grade 6. We followed as many students from the first sample as possible, but also included new students who moved into participating classes. By Grade 6, participation rate of the students in the study was 82%.

At the end of Grade 6, about two weeks before testing the participant children, questionnaires were sent to all parents and teachers. Mothers and language teachers were asked to rate students' EC and TP. Research assistants who also tested children's reading skills collected the completed questionnaires. All assessments took place in a group setting during regular 45-minute lessons. Tests were administered with pen and paper.

2.3. Measures

2.3.1. Effortful control

Parent and teacher reports of children's EC were modified versions of the Effortful Control Scale from the Early Adolescent Temperament Questionnaire–Revised parent form (EATQ-R; Ellis & Rothbart, 2001). The items were changed to be applicable for both parents and teachers. All changed items were discussed with a group of psychologists and piloted prior to the study. Two items from the original parent report form were not included in the teacher-report form due to their unsuitability within a school context. Both teachers and parents clearly understood the remaining items (see Appendix 1); thus, no further modifications were needed. The EATQ-R Effortful Control Scale is comprised of 18 items that assess activation control (the capacity to perform an action when there is a strong tendency to avoid it), attention (the capacity to focus attention as well as shift attention when desired), and inhibitory control (the capacity to plan and to suppress inappropriate responses). Each item was scored on a scale ranging from 1 (almost always untrue) to 5 (almost always true), with higher scores indicating greater EC.

2.3.2. Task persistence

Sixth-grade language teachers and mothers assessed children's TP using the Behavioral Strategy Rating Scale (Onatsu & Nurmi, 1995; Zhang et al., 2011). This scale has been used in several earlier studies conducted in Estonia (e.g., Kikas, Peets, & Hodges, 2014). Teachers and mothers were first asked to recall a specific student's typical behavior in

a classroom/homework learning situation, and then to rate the child's behavior on a five-point scale (1 = not at all, 5 = to a great extent). Two positively-worded descriptions measured the degree to which children showed persistence (e.g., "shows activity and persistence in activities and solving tasks") and three negatively-worded items described lack of persistence, helplessness, and task-irrelevant behaviors (e.g., "easily loses his/her focus when the activity or task is not going well"). Scores ranged from 1 to 5.

2.3.3. Reading skills

Reading fluency was assessed using an adapted and translated version of the Finnish ALLU normative test battery designed for students in Grades 1 through 6 (i.e., 6- to 12-year-old students; Lindeman, 1998). The procedure was the same as in Finnish version. The test is comprised of 80 items, with one picture [e.g., *tigu* (snail)] and four phonologically similar words options for each item [e.g., *tegu* (act), *tibu* (chick), *tigu* (snail), *tina* (tin)]. One- to four-syllable words are sequenced based on length and degree of phonological difficulty, with phonologically-easier and shorter words at the beginning of the test, and more difficult and longer words at the end. All items were written on one-sided sheets of paper (one sheet for practicing, and eight for the test). The students' task was to identify as many correct picture-word pairs as possible within two minutes. The test was administered in a group setting. The sum total of all correctly-matched items was used as the measure for reading fluency (maximum score = 80).

Reading comprehension was also assessed using an Estonian translation of the ALLU test battery for sixth-grade students (Lindeman, 1998). Students were asked to first read an expository text about customer rights and responsibilities (586 words in length) and then answer 12 multiple-choice comprehension questions, each with four alternative-choice answers. The test was administered in a group setting without a time limit. Scoring was based on the total number of correct responses (maximum score = 12). Internal consistency was good (Cronbach's alpha = 0.83).

2.4. Data analysis

Confirmatory factor analyses (CFA) were tested using the Mplus program (Version 7.3; Muthén & Muthén, 1998–2016). All analyses for maternal and teacher ratings were carried out separately. As students were nested into classes, the intra-class correlations (ICCs) of all measured variables were calculated first. ICCs for the variables ranged from 0.003 to 0.14. To avoid bias originating from class-level variability, the estimator 'type = complex' was used in the SEM analysis.

The following steps were used to develop and test the proposed model. First, individual factor models were run for the EATQ-R subscales (attention, inhibitory control, activation control) and the BSR scale (task persistence). Each model was checked for adequate factor loadings. Modification indices were examined for subscale models that did not have a good fit. Suggestions for correlations between item residual variances were considered when theoretically justified (e.g., the items shared the same method effect or were similar in content) and in order of largest to smallest modification index value until a good model fit was achieved (e.g., Mueller & Hancock, 2008). In an effort to prevent overfitting models, we did not add new modifications in subsequent models.

Second, attention, inhibitory control, and activation control were modeled together, with correlations between all three factors. Chi-square difference tests using the Satorra-Bentler scaled chi-square (see Satorra & Bentler, 2001) were conducted to compare the model fit of a correlated-factor model and a one-factor model with all items loading on a single EC factor. Finally, we tested a bifactor model in which all items loaded onto a common factor representing the shared variance across items, as well as onto their specific subscale factors representing the unique variance associated with each subscale not accounted for by the common factor (Chen et al., 2006; Chen, Hayes, Carver, Laurenceau, & Zhang, 2012). Factor correlations in this bifactor model were set to zero because the common factor already captured what was shared between factors (Chen et al., 2006; Muthén and Muthén, 1998–2014). We first tested the full bifactor model and then modified the model based on the significance of factor variances and loading patterns. If variance was not significant for a specific factor, it was concluded that the common factor fully accounted for the variances of the items that loaded on that factor; thus, the specific factor was eliminated. Model fits of these final models were then compared with those of the correlated factor and one-factor models.

Third, the TP factor was added to these final bifactor EC models and correlations between TP, general, and specific EC factors were estimated. Finally, we tested a bifactor model where TP factor items also loaded on a common EC factor and on a specific TP factor. Factor correlations in this bifactor model were again set to zero. The fit of this model was compared to the correlated EC and TP model.

Since the data were not distributed normally, the parameters of the models were estimated using the maximum likelihood procedure with non-normality robust standard errors (MLR). Multiple fit indices were employed, including χ^2/df, Bentler's (1990) Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA), to assess the adequacy of the measurement models. A non-significant χ^2 value or a χ^2/df, which was < 5 (Wheaton, Muthén, Alwin, & Summers, 1977), gave a rough indication that the model may fit the data. According to Hu and Bentler (1999), values above 0.95 for CFI and values below 0.06 for RMSEA indicate a good fit between the hypothesized model and the observed data, while the values above 0.90 (Hu & Bentler, 1999) for CFI and values below 0.08 (MacCallum, Browne, & Sugawara, 1996) for RMSEA indicate adequate fit.

3. Results

3.1. Individual EC subscale and TP factor models

3.1.1. Attention

The fit of the teacher-rated attention subscale factor (six items) initially had an acceptable fit according to the CFI, but a poor fit according to the RMSEA (χ^2 = 42.85, *df* = 9, $p < 0.001$, CFI = 0.95, RMSEA = 0.07 (0.05–0.09)). After inspecting the parameter estimates and modification indices, we decided to omit one item (Item 11) and included the residual correlation between Items 8 and 10, both of which measure ease or difficulty of concentration, and between 9 and 10, both of which refer to ignoring outside distractions. After these changes, the model fit improved (χ^2 = 7.97, *df* = 3, $p = 0.05$, CFI = 0.99, RMSEA = 0.05 (0.01–0.09)). The fit of the parent-rated Attention subscale factor (six items) initially had a poor fit (χ^2 = 49.41, *df* = 9, $p < 0.001$, CFI = 0.91, RMSEA = 0.09 (0.06–0.11)). After omitting one item (Item 11) and including the residual correlation between Items 9 and 10, the fit was excellent (χ^2 = 4.58, *df* = 4, $p = 0.33$, CFI = 0.99, RMSEA = 0.02 (0.00–0.07)).

3.1.2. Activation control

The fit of the teacher-rated Activation-Control subscale factor (six items) was initially poor (χ^2 = 84.97, *df* = 9, $p < 0.001$, CFI = 0.92, RMSEA = 0.11 (0.09–0.13)). After inspecting the parameter estimates and modification indices, we omitted Item 5. This change resulted in a very good model fit (χ^2 = 9.88, *df* = 5, $p = 0.08$, CFI = 0.99, RMSEA = 0.04 (0.00–0.07)). The parent-rated Activation-Control subscale factor (seven items) had an acceptable fit (χ^2 = 54.81, *df* = 14, $p < 0.001$, CFI = 0.93, RMSEA = 0.07 (0.05–0.09)). However, Item 5 had low factor loading (< 0.35) and was therefore removed from further analyses. In addition, residual correlations were allowed between Items 2 and 4, both of which refer to immediate action in unpleasant situations, and between Items 3 and 7, both of which refer to difficulties in starting homework at home. After these changes, the fit of the model improved (χ^2 = 15.67, *df* = 7, $p = 0.03$, CFI = 0.98, RMSEA = 0.05

(0.01–0.08)).

3.1.3. Inhibitory control

The fit of the teacher-rated Inhibitory-Control subscale factor (four items) initially had a good fit according to the CFI, but a poor fit according to the RMSEA ($\chi^2 = 11.26$, $df = 2$, $p < 0.001$, CFI = 0.97, RMSEA = 0.08 (0.04–0.13)). Adding residual correlations between Items 17 and 18, which represented the method effect, improved the model fit significantly, although the RMSEA remained high (but still acceptable; $\chi^2 = 4.22$, $df = 1$, $p = 0.04$, CFI = 0.99, RMSEA = 0.07 (0.01–0.14)). The fit of the parent-rated Inhibitory-Control subscale factor (five items) was acceptable but not very good ($\chi^2 = 28.37$, $df = 5, p < 0.001$, CFI = 0.94, RMSEA = 0.09 (0.06–0.12)). Allowing residual correlations between Items 17 and 18 significantly improved the model fit ($\chi^2 = 7.17$, $df = 4, p = 0.12$, CFI = 0.99, RMSEA = 0.04 (0.00–0.08)).

3.1.4. Task persistence

The fit of the teacher-rated TP factor was good according to CFI but poor based on other indices ($\chi^2 = 33.85$, $df = 5$, $p < 0.001$, CFI = 0.97, RMSEA = 0.09 (0.06–0.12)). Adding residual correlations between Items 2 and 4, which represented the method effect, significantly improved the model fit ($\chi^2 = 5.97$, $df = 4$, $p = 0.20$, CFI = 0.99, RMSEA = 0.03 (0.00–0.07)). Similarly, the parent-rated TP factor did not have a good fit initially ($\chi^2 = 79.19$, $df = 5$, $p < 0.001$, CFI = 0.91, RMSEA = 0.16 (0.13–0.19)), but adding residual correlations between Items 2 and 4 significantly improved the fit ($\chi^2 = 7.17$, $df = 4$, $p = 0.13$, CFI = 0.99, RMSEA = 0.04 (0.00–0.08)).

3.2. EC – one-factor, correlated subscale factors, or bifactor model

First, the Attention, Inhibitory-Control, and Activation-Control subscales were modeled as a three-factor model for teacher and parent ratings separately, allowing for correlations between all three factors (3-Factor Correlated). Second, a one-factor model with all items of the three subscales loading on a single EC factor was created for teacher and parent ratings separately (1-Factor). Finally, a bifactor model with a common EC factor and specific Attention, Activation-Control, and Inhibitory-Control factors was tested and compared to the correlated subscale factor and one-factor model (see the model fit indices and chi-square difference test results in Table 1), again for teacher and parent ratings separately.

The first version of the bifactor model, with a common teacher-rated EC factor and specific Attention, Activation-Control, and Inhibitory-Control factors, revealed no significant variance associated with Attention-specific and Activation-Control-specific factors, although the variance associated with the Inhibitory-Control-specific factor and the common EC factor was significant. Therefore, we modified the model to eliminate the Attention-specific and Activation-Control-specific factors. Because Item 18 had a non-significant negative loading on the Inhibitory-Control-specific factor, we allowed this item to load only on the common EC factor. The fit of the Common EC + Inhibitory Control model was acceptable (see Table 1) and significantly better as compared to the fit of 3-Factor Correlated and 1-Factor model.

Similarly, the initial version of the bifactor model with the common parent-rated EC factor and specific Attention, Activation-Control, and Inhibitory-Control factors revealed a significant variance associated only with the Inhibitory-Control-specific factor and the common EC factor. Therefore, we eliminated the Attention-specific and Activation-Control-specific factors. Because Item 18 had non-significant loading on the Inhibitory-Control-specific factor, we allowed this item to load only on the common EC factor. The fit of the Common EC + Inhibitory Control model was acceptable (see Table 1) and significantly better compared to the model fit of the 3-Factor Correlated and 1-Factor model.

3.3. Shared variance of EC and TP

Next, we included TP in the final bifactor model. First, we estimated task persistence as a separate factor as well as correlations of TP with the common EC, TP, and Inhibitory-Control-specific factors. In the next model, TP items were allowed to load on the common EC factor as well as on the TP-specific factor.

The fit of the model with the teacher-rated TP factor, the common EC factor, and the Inhibitory-Control-specific factor was acceptable (see Table 2 for fit indices for the Common EC + Inhibitory-Control-specific + TP model). The standardized correlation between the TP and the common EC factor was r = 0.98, $p < 0.001$, while the standardized correlation between the TP and the Inhibitory-Control-specific factor was non-significant. The bifactor model with the common EC factor, the Inhibitory-Control-specific factor, and the TP-specific factor showed that no significant variance was associated with the TP-specific factor (model Common EC + Inhibitory-Control & TP-specific in Table 2). However, the elimination of the TP-specific factor resulted in a significantly decreased model fit. Inspection of the factor loadings of the TP-specific factor showed that Items 2 and 4 had non-significant loadings. Allowing only Items 1, 3, and 5 to load on the TP-specific factor resulted in a better fitting model (scaled $\chi^{2\text{diff}} = 13.01$, $df^{\text{diff}} = 1$, $p < 0.001$) compared to the EC + Inhibitory-Control-specific + TP model. See Fig. 1 for the final model.

The fit of the model with the parent-rated TP factor, the common EC factor, and the Inhibitory-Control-specific factor was acceptable (model Common EC + Inhibitory-Control-specific + TP in Table 2). The standardized correlation between the TP factor and the common EC factor was r = 0.88, $p < 0.001$, while the standardized correlation between the TP factor and the Inhibitory-Control-specific factor was r = −0.12, $p < 0.05$. The bifactor model with the common EC factor, the Inhibitory-Control-specific factor, and the TP specific factor showed that, in addition to the Inhibitory-Control-specific factor, variance associated with the TP-specific factor (model Common EC + Inhibitory-Control & TP-specific in Table 2) was significant. The fit of this model was significantly better as compared to the EC + Inhibitory-Control-specific + TP model with scaled $\chi^{2\text{diff}} = 22.52$, $df^{\text{diff}} = 3$, $p < 0.001$. See Fig. 2 for the final model.

Table 1
Model fit statistics of the one factor, correlated subscale factors and bifactor models of EC.

Scale	Model	χ^2 (*df*)	χ^2/df	CFI	RMSEA (90% CI)	$\chi^{2\ \text{diff}}$ (df^{diff})
Teacher ratings	3-Factor Correlated	415.03 (71)	5.85	0.91	0.08 (0.07–0.09)	
	1 Factor	420.26 (74)	5.68	0.91	0.08 (0.07–0.09)	11.33 (3)*
	Common EC + Inhibitory Control	298.29 (71)	4.20	0.94	0.07 (0.06–0.07)	116.74 (0)
Maternal ratings	3-Factor Correlated	296.84 (97)	3.06	0.91	0.06 (0.05–0.07)	
	1-Factor	328.31 (100)	3.27	0.89	0.06 (0.05–0.07)	26.36 (3)*
	Common EC + Inhibitory Control	252.57 (96)	2.64	0.93	0.05 (0.04–0.06)	79.44 (1)*

Note. $\chi^{2\ \text{diff}}$ was computed between 1-Factor and 3-Factor Correlated models; Common EC + Inhibitory Control and 3-Factor Correlated models.
* Significant $\chi^{2\ \text{diff}}$ ($p < 0.05$) using the Satorra-Bentler scaled chi-square difference test (Satorra & Bentler, 2001).

Table 2
Model fit statistics of bifactor models of EC and TP.

Scale	Model	χ^2 (*df*)	χ^2/df	CFI	RMSEA (90% CI)	$\chi^{2\ diff}$ (df^{diff})
Teacher ratings	1. Common EC + Inhibitory Control specific + TP	555.55 (143)	3.88	0.94	0.06 (0.06–0.07)	
	2. Common EC + Inhibitory Control & TP specific	545.581 (142)	3.84	0.94	0.06 (0.06–0.07)	13.01* (1)
Maternal ratings	1. Common EC + Inhibitory Control specific + TP	448.93 (178)	2.52	0.93	0.05 (0.04–0.06)	
	2. Common EC + Inhibitory Control & TP specific	426.19 (175)	2.44	0.94	0.05 (0.04–0.06)	22.52* (3)

Note. $\chi^{2\ diff}$ was computed between models 1 and 2 for both teacher and maternal ratings.
* Significant $\chi^{2\ diff}$ ($p < 0.05$) using the Satorra-Bentler scaled chi-square difference test (Satorra & Bentler, 2001).

3.4. Associations with reading skills

Finally, we were interested in exploring the associations of the common EC, the specific Inhibitory-Control, and the TP factors with reading fluency and reading comprehension. Reading fluency and reading comprehension were entered into the model as outcome variables, and paths from the common EC, the specific Inhibitory-Control, and the TP factors were estimated. No other covariates were added to the models.

The model with teacher ratings fit the data well ($\chi^2 = 621.55$, $df = 174$, $p < 0.001$, CFI = 0.94, RMSEA = 0.06 (0.05–0.06)) (see Fig. 3 for path coefficients and correlations). The common EC factor was positively associated with both reading fluency and reading comprehension skills. The specific TP factor was also positively associated with both reading fluency and reading comprehension, whereas the specific Inhibitory-Control factor was negatively associated with both of these skills. The teacher-rated common EC factor, the specific Inhibitory-Control factor, and the TP factor explained together 15% of the variance in reading fluency and 23% of the variance in reading comprehension.

The model with parent ratings fit the data well ($\chi^2 = 491.88$, $df = 211$, $p < 0.001$, CFI = 0.93, RMSEA = 0.04 (0.04–0.05)) (see Fig. 4 for path coefficients and correlations). Similar to the teacher model, the common EC factor was positively associated with both reading fluency and reading comprehension skills. The specific TP factor was positively associated with reading fluency, and the trend for positive association with reading comprehension was also apparent ($p = 0.06$). The specific Inhibitory-Control factor was negatively associated only with reading fluency. The mother-rated common EC factor, the specific Inhibitory-Control factor, and the TP factor explained together 8% of the variance in reading fluency and 7% of the variance in reading comprehension skills.

4. Discussion

Using maternal and teacher reports, we studied to what extent EC and TP are differentiable, and further analyzed their relationship with reading skills. Our results demonstrated that, as rated by mothers and teachers, TP contributed significantly to the common EC factor, although a small amount of unique variance was associated with TP. The common EC and the specific TP factors were both positively associated with reading fluency and reading comprehension; however, teacher ratings explained a greater amount of variance in these skill areas.

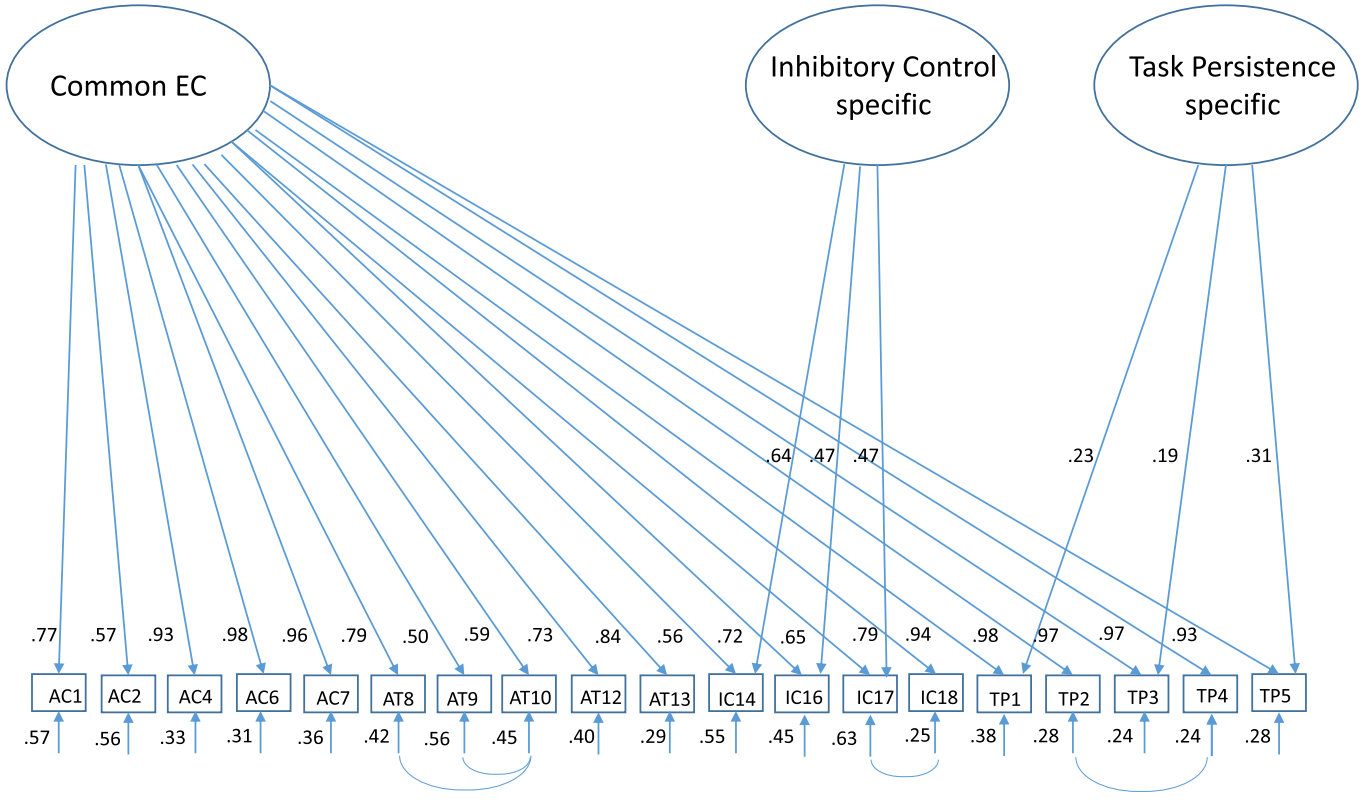

Fig. 1. Bifactor model of teacher rated EC and TP. The common EC factor captures what is shared across the items whereas each specific factor captures what is unique to the items in that facet. EC = Effortful Control; AC = Activation Control; AT = Attentional Focusing; IC = Inhibitory Control; TP = Task Persistence.

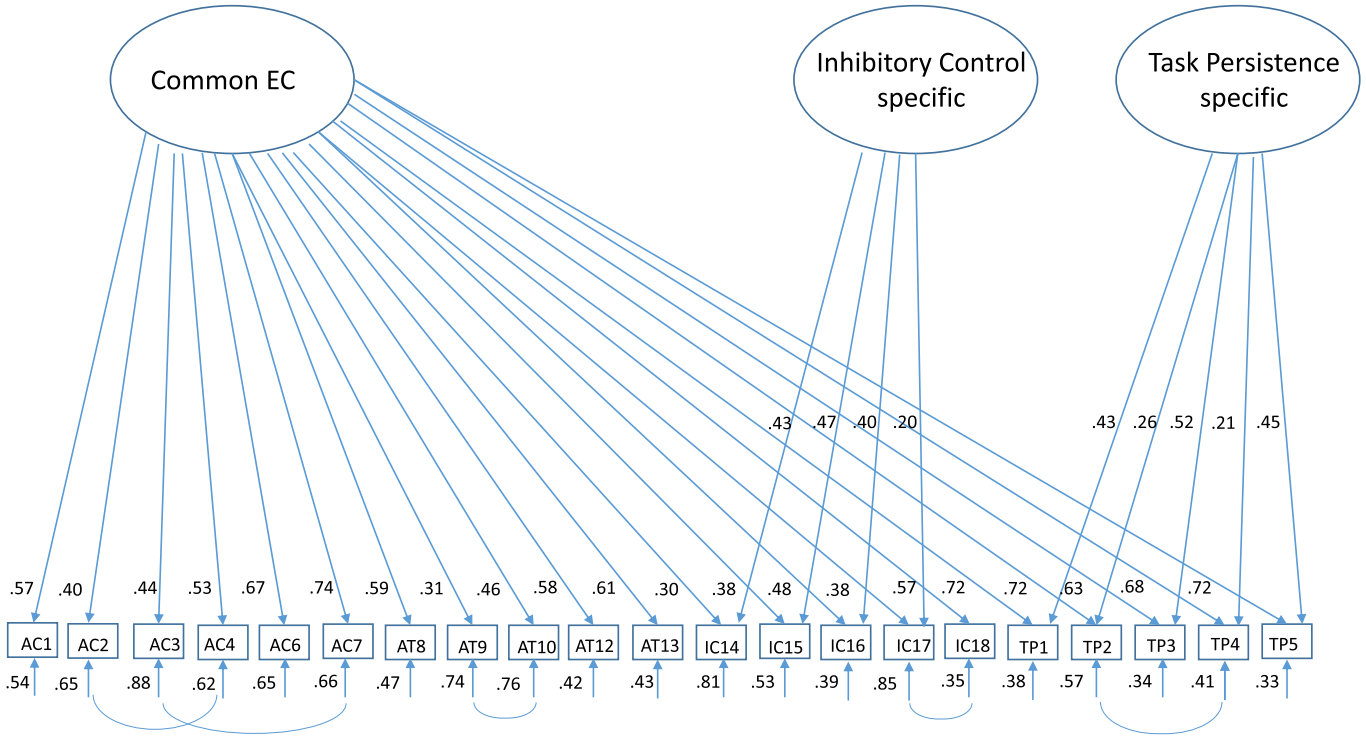

Fig. 2. Bifactor model of mother rated EC and TP. The common EC factor captures what is shared across the items whereas each specific factor captures what is unique to the items in that facet. EC = Effortful Control; AC = Activation Control; AT = Attentional Focusing; IC = Inhibitory Control; TP = Task Persistence.

4.1. Effortful control - a multifaceted construct

EC includes behavior tendencies such as activation (approach), inhibition (withdrawal), and the shifting and focusing of attention (Bridgett et al., 2013; Eisenberg et al., 2010; Lengua et al., 2008; Rothbart & Bates, 2006). Thus, the widely-used questionnaire for assessing EC (EATQ–R; Ellis & Rothbart, 2001) is comprised of three subscales: Activation Control, Attention Focusing, and Inhibitory Control. However, its latent structure has not been thoroughly investigated (Snyder et al., 2015), and it has been recommended to combine the three subscales into one EC composite scale (Ellis & Rothbart, 2001). Remarkably, Snyder et al. (2015) found that, besides the general EC factor, unique variance is also associated with the Activation-Control-specific factor. Our results also suggest that most variance in EC is indeed accounted for by what is common across these three aspects of EC, although there was also a factor specific to Inhibitory Control. Moreover, this factor emerged in both maternal and teacher reports. These findings demonstrate the complexity of EC and reinforce the possibility that individuals themselves (children, adolescents) and outside observers (parents, teachers) may interpret EC differently. Snyder et al. (2015) hypothesized that the Activation-Control-specific factor may represent the motivation to be self-disciplined and perform tasks well,

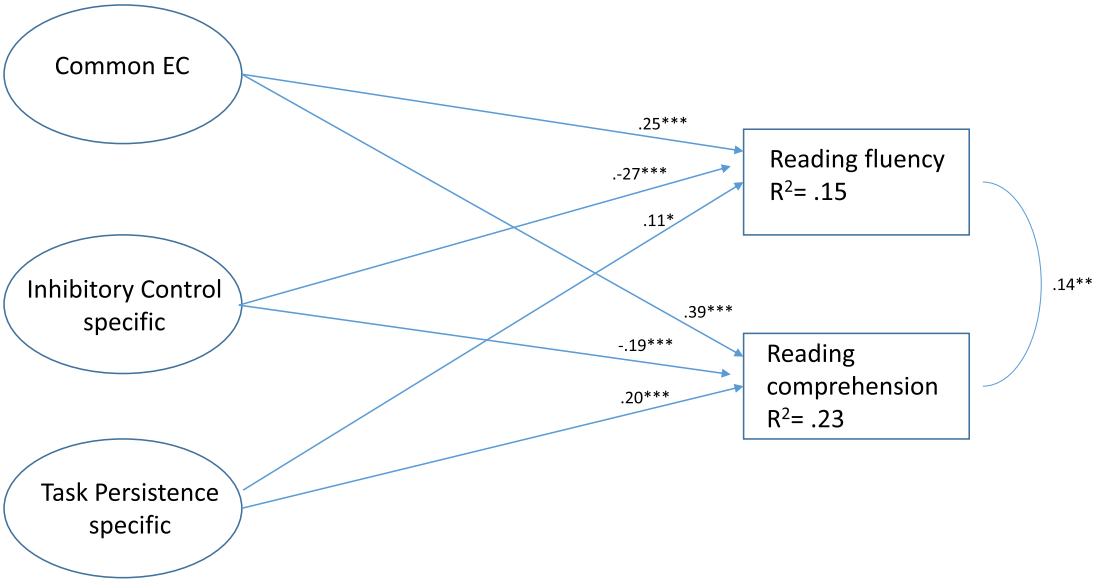

Fig. 3. Common and specific variances of EC and TP and their associations to reading skills. Path coefficients are presented for teachers' ratings. * = $p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

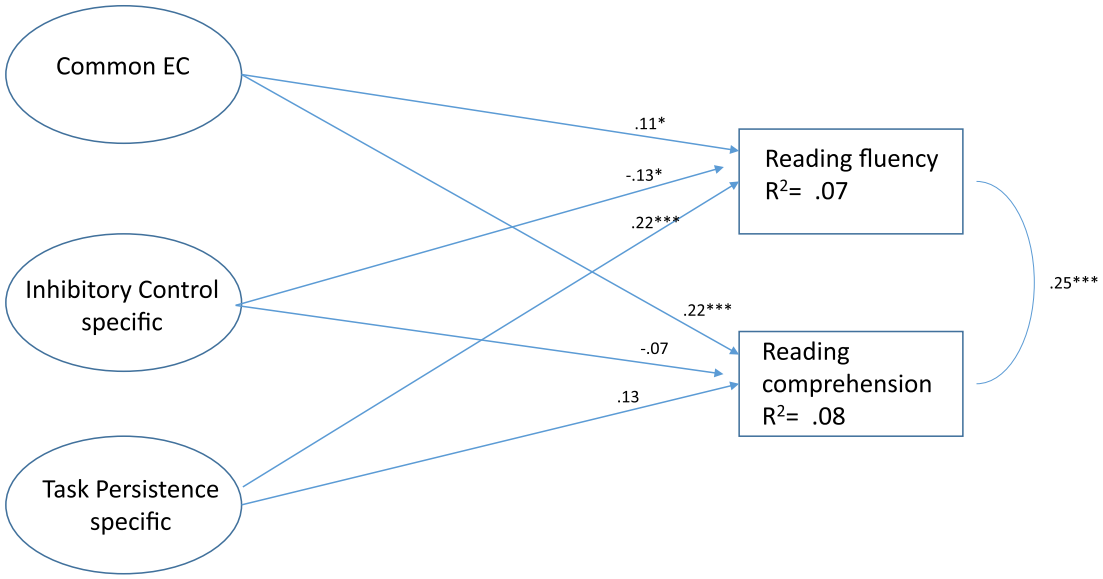

Fig. 4. Common and specific variances of EC and TP and their associations to reading skills. Path coefficients are presented for mothers' ratings. * = $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

and it may also include the over-control and fear of failure, a trait which is sometimes also accompanied by the adult personality trait of conscientiousness (e.g., Boyce, Wood, & Brown, 2010). These aspects may not be clearly represented in children's overt behavior, as reported by teachers and parents. Although we will make some suggestions about the Inhibitory-Control-specific factor and its representation when we discuss the associations between EC dimensions and reading skills, the present study does not allow us to draw any conclusions in that respect. However, based on our results, we suggest that whenever the sample size is sufficient, the latent bifactor model rather than composite scores of the three subscales should be used. The bifactor model estimates the common EC factor with greater content validity than any of its facets. The bifactor model also allows us to partial out the commonality among the facets when testing their unique associations with external variables. This provides us a more nuanced picture of how EC and its different facets are linked to other variables.

4.2. Effortful control and task persistence – their shared and unique variances

The main focus of the present study was to investigate the possible overlap in children's EC and TP, as reported by mothers and language teachers. Although the items of both questionnaires tapped children's overt behavior, the EATQ-R included descriptions of heterogeneous situations, whereas the BSRS described only situations related to academic tasks. As expected, we found that both teacher and parent ratings of children's TP largely contribute to the common EC factor. While the BSRS has its roots in motivation theories (Onatsu-Arvilommi & Nurmi, 2000; Zhang et al., 2011), and TP has been discussed in relation to aspects of a child's learning motivation (e.g., beliefs, approach or avoidance goals, self-efficacy), our findings indicate that temperamental tendencies (Rothbart & Hwang, 2007) and cognitive self-regulatory capacities (Diamond, 2013) play a role in task-persistent learning behavior. Drake et al. (2014) argued that by being able to resist distractions, manage frustrations, focus attention, and persist at challenging tasks, children with better self-regulatory abilities are likely to experience a greater sense of efficacy in dealing with challenge, gain greater intrinsic (e.g., satisfaction) and extrinsic (e.g., praise) rewards from their successes, and manage the emotions associated with setbacks more effectively. Repeated experiences like these would be expected to increase motivation to engage in learning, and thus stabilize this tendency over time (Rothbart & Jones, 1998). These self-regulatory skills may be especially useful in middle school, when learning requires more engagement and friend-related activities become more important (see Eccles & Roeser, 2005; Mahatmya et al., 2012; Steinberg & Monahan, 2007). Hence, multiple theoretical perspectives should be considered simultaneously for a deeper understanding of the task-persistent versus task-avoidant behavior, its causes, and the mechanism by which it affects academic performance.

TP largely contributed to the common EC factor, but also showed some unique variance, although there were differences in its content between teacher and parent ratings. In the teachers' model, the fit decreased significantly when the TP-specific factor was removed, although variance associated with it was non-significant. After inspecting the factor loadings, only three reversed items (tapping task-avoidance) from the BSRS scale seemed to contribute significantly to the TP-specific factor, resulting in the best model fit and near-significant variance of this factor. However, in the model with parent ratings, the variance associated with the TP-specific factor was statistically significant, and all of the BSRS scale items also loaded significantly onto this factor, in addition to the loadings on the common EC factor. At least three explanations could be offered for slightly different factor structures of parent and teacher ratings.

First, the BSRS scale items are all related only to performance during academic tasks, whereas the EATQ-R covers a broader repertoire of behaviors. Children may regulate their behavior differently when doing schoolwork at home versus other activities their parents observe them doing at home. This may be due to motivational factors, for example (Elliot & Thrash, 2002, 2010). Second, while parents can observe their child's behavior in multiple contexts, teachers observe students' behavior in a single, classroom-specific context. This applies especially to middle and secondary school, where each subject is taught by a different teacher; thus, for example, the language teacher can observe the student only during his or her language lessons. Therefore, the overlap between EC and academic task-related TP might be greater for teacher ratings as compared to parent ratings. The three reversed items, which contributed to the specific TP factor in the teacher's model, may reflect the method effect also shown by Zhang et al. (2011). But they might also reflect a student's low task-persistence not only because of self-regulatory difficulties, but also due to low self-efficacy and low feelings of competence (Onatsu-Arvilommi & Nurmi, 2000). Additionally, children often exhibit different behaviors in various

contexts, especially when in the company of different people. Earlier studies on TP (or task avoidance) and other behavioral problems have demonstrated quite low inter-rater agreement (Achenbach, McConaughy, & Howell, 1987; Merrell, 2000; Zhang et al., 2011). It is also possible that parents might be better able to grasp the full range of a child's behaviors present in various contexts, whereas teachers might be better able to evaluate a child's learning behaviors. For this reason, teacher ratings are usually considered much better predictors of children's academic skills and academic performance (Rudasill et al., 2014).

4.3. Common and specific variances of EC and task-persistence and their associations with reading skills

When investigating multifaceted constructs, one of the advantages of bifactor models is the possibility to estimate the associations of common and unique variances with various outcome variables to give a more nuanced picture of the constructs and their associations. Our results showed that both the parent- and teacher-rated common EC factor and the unique TP factor were positively associated with reading skills. On the other hand, the teacher-rated Inhibitory-Control-specific factor was negatively associated with both reading fluency and reading comprehension, whereas the parent-rated Inhibitory-Control-specific factor was negatively associated with reading fluency only. The negative association between the Inhibitory-Control-specific factor and reading skills means that the lower inhibitory control scores associated with this unique variance are linked to higher reading skills. We can only hypothesize the essence of the Inhibitory-Control-specific factor. One inhibition item that reflects the ability to focus on more long-term goals (i.e., “The child is usually able to stick with his/her plans and goals.”) had significant loading only onto the common EC factor. The other items that loaded significantly onto the Inhibitory-Control-specific factor seem to reflect drive, curiosity, and impatience, all of which are common characteristics of gifted children (Webb, 2001). For this reason, children with higher abilities and higher academic skills may sometimes appear oppositional, argumentative, and even hyperactive when interacting with the teachers and parents (Baum, Olenchak, & Owen, 1998; Webb, 2001). These tendencies might be reinforced in late childhood and early adolescence.

Teacher ratings of EC and TP explained a greater amount of variance in reading skills than parent ratings. As suggested previously, a strong link between teacher ratings of children's behavior and academic skills has also been found in other studies (Rudasill et al., 2014) and could be due to the fact that teachers observe children's behavior primarily in learning-specific contexts. Therefore, their ratings characterize children's learning-related behavior more precisely. In addition, teachers can observe the behavior of many children every day, which gives them a wider frame of reference in evaluating behavior.

As expected, teacher-rated EC and TP explained a greater amount of variance in reading comprehension as compared to reading fluency. The Estonian language is orthographically transparent, and word recognition skills are acquired relatively easily (Seymour, Aro, & Erskine, 2003). After a certain amount of practice, reading fluency may become automatized to such an extent that the child's effort and persistence have little effect on it. However, reading comprehension puts a greater load on the self-regulatory processes, as this activity is cognitively more demanding. When a child is unable to sustain attention and persistence in a reading task, what suffers are the basic processes involved in reading comprehension, like integrating information within and across paragraphs and making inferences based on the text. Therefore, higher EC and TP may facilitate reading comprehension tasks.

5. Limitations and conclusions

The present study also has some limitations. First, the data used in the study were cross-sectional. A longitudinal design would allow us to investigate any changes in the shared and unique variances of the EC and task-persistent behavior over time, as well as their associations with other child-related outcome variables.

Second, only maternal and teacher reports of children's EC and TP were included in the present study. The shared and unique variances of children's self-reports of their EC and TP should also be investigated, as the interrelations between these constructs might be different to adult ratings.

Third, a wider range of outcome and control variables should be included in future studies. For instance, one could measure children's cognitive abilities, executive functions, self-reported motivational beliefs, and a wider range of academic skills. This would help to better describe the unique variances of the specific factors.

Despite these limitations, our results add to the understanding of EC as a multifaceted construct. The present study has demonstrated that EC and TP constructs, as measured by teacher and parent ratings, are largely overlapping. Our results also imply that teacher and parent ratings should not be directly compared, since the factor structures of the ratings are somewhat different and reflect a focus on different aspects of a child's behavior. The Inhibitory-Control-specific factor and its negative associations with reading skills demonstrate that the use of composite scores might blur the results and lead to misinterpretations. Therefore, future studies should use latent factors instead of composite scores whenever possible to better capture the multifaceted nature of EC as well as its causes and connections to various other child outcome measures. In addition, TP as measured by the BSRS should not be interpreted only from a motivational perspective; instead, multiple theoretical perspectives should be considered when interpreting the associations of questionnaire-based EC and TP with various child-related outcomes, including academic achievement.

Appendix 1. Early Adolescent Temperament Questionnaire – Effortful Control subscale. Parent and teacher report forms

The child:

1. Has a hard time finishing things on time (R)
2. If having a problem with someone, usually tries to deal with it right away.
3. Usually does something fun for a while before starting her/his homework, even though s/he is not supposed to (R) **
4. When asked to do something, does it right away, even if s/he doesn't want to.*
5. Usually finishes her/his (home)work before it's due
6. Usually gets started right away on difficult assignments.
7. Usually puts off working on a project until it is due. (R)
8. Finds it easy to really concentrate on a problem
9. When interrupted or distracted, forgets what s/he was about to say. (R)
10. Has a difficult time tuning out background noise and concentrating when trying to study. (R)
11. Is good at keeping track of several different things that are happening around her/him.*
12. Is often in the middle of doing one thing and then goes off to do something else without finishing it. (R)
13. Pays close attention when someone tells her/him how to do something
14. Has a hard time waiting his/her turn to speak when excited. (R)
15. Opens presents before he/she is supposed to (R) **
16. Is more likely to do something s/he shouldn't do the more s/he tries to stop her/himself. (R)
17. Is able to stop him/herself from laughing at inappropriate times
18. Is usually able to stick with his/her plans and goals.

Note. R = reversed item; * = item was removed due to low factor-loadings; ** = item was present only in parent-report form.

References

Achenbach, T. M., McConaughy, S. H., & Howell, C. T. (1987). Child-adolescent behavioral and emotional problems: Implications of cross-informant correlations for situational specificity. *Psychological Bulletin, 101*, 213–232. http://dx.doi.org/10.1037/0033-2909.101.2.213.

Allan, N. P., & Lonigan, C. J. (2011). Examining the dimensionality of effortful control in preschool children and its relation to academic and socioemotional indicators. *Developmental Psychology, 47*(4), 905–915. http://dx.doi.org/10.1037/a0023748.

Anderman, E., & Maehr, M. (1994). Motivation and schooling in middle grades. *Review of Educational Research, 64*, 287–309.

Andersson, H., & Bergman, L. R. (2011). The role of task persistence in young adolescence for successful educational and occupational attainment in middle adulthood. *Developmental Psychology, 47*(4), 950–960.

Aunola, K., Leskinen, E., Lerkkanen, M., & Nurmi, J. (2004). Developmental dynamics of math performance from preschool to grade 2. *Journal of Educational Psychology, 96*(4), 699–713. http://dx.doi.org/10.1037/0022-0663.96.4.699.

Aunola, K., Nurmi, J.-E., Niemi, P., Lerkkanen, M.-K., & Rasku-Puttonen, H. (2002). Developmental dynamics of achievement strategies, reading performance, and parental beliefs. *Reading Research Quarterly, 37*(3), 310–327.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York, NY: Freeman.

Baum, S. M., Olenchak, F. R., & Owen, S. V. (1998). Gifted students with attention deficits: Fact and/or fiction? Or, can we see the forest for the trees? *The Gifted Child Quarterly, 42*, 96–104.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107*(2), 238–246.

Blair, C., Calkins, S., & Kopp, L. (2010). Self-regulation as the interface of emotional and cognitive development: Implications for education and academic achievement. *Handbook of personality and self-regulation* (pp. 64–90). Wiley-Blackwell. http://dx.doi.org/10.1002/9781444318111.ch4.

Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development, 78*, 647–663. http://dx.doi.org/10.1111/j.1467-8624.2007.01019.x.

Boyce, C. J., Wood, A. M., & Brown, G. D. A. (2010). The dark side of conscientiousness: Conscientious people experience greater drops in life satisfaction following unemployment. *Journal of Research in Personality, 44*, 535–539. http://dx.doi.org/10.1016/j.jrp.2010.05.001.

Bridgett, D. J., Oddi, K. B., Laake, L. M., Murdock, K. W., & Bachmann, M. N. (2013). Integrating and differentiating aspects of self-regulation: Effortful control, executive functioning, and links to negative affectivity. *Emotion, 13*(1), 47–63. http://dx.doi.org/10.1037/a0029536.

Checa, P., & Rueda, M. R. (2011). Behavioral and brain measures of executive attention and school competence in late childhood. *Developmental Neuropsychology, 36*(8), 1018–1032. http://dx.doi.org/10.1080/87565641.2011.591857.

Chen, F. F., Hayes, A., Carver, C. S., Laurenceau, J.-P., & Zhang, Z. (2012). Modeling general and specific variance in multifaceted constructs: A comparison of the bifactor model to other approaches. *Journal of Personality, 80*, 219–251. http://doi.org/10/d6ht4b.

Chen, F. F., West, S. G., & Sousa, K. H. (2006). A comparison of bifactor and second-order models of quality of life. *Multivariate Behavioral Research, 41*, 189–225.

Covington, M. V. (1984). The self-worth theory of achievement motivation: Findings and implications. *The Elementary School Journal, 85*, 5–20.

Deater-Deckard, K., Mullineaux, P. Y., Petrill, S. A., & Thompson, L. A. (2009). Effortful control, surgency, and reading skills in middle childhood. *Reading and Writing, 22*(1), 107–116. http://dx.doi.org/10.1007/s11145-007-9111-9.

Diamond, A. (2013). Executive functions. *Annual Review of Psychology, 64*(1), 135–168. http://dx.doi.org/10.1146/annurev-psych-113011-143750.

Diener, C. I., & Dweck, C. S. (1978). An analysis of learned helplessness: Continuous changes in performance, strategy, and achievement cognitions following failure. *Journal of Personality and Social Psychology, 36*, 451–462.

Drake, K., Belsky, J., & Fearon, R. M. P. (2014). From early attachment to engagement with learning in school: The role of self-regulation and persistence. *Developmental Psychology, 50*, 1350–1361. http://dx.doi.org/10.1037/a0032779.

Eccles, J. S., & Roeser, R. W. (2005). School and community influences on human development. In M. H. Bornstein, & M. E. Lamb (Eds.). *Developmental science: An advanced textbook* (pp. 513–556). (5th ed.). Mahwah, NJ: Erlbaum.

Eisenberg, N., Cumberland, A., Spinrad, T. L., Fabes, R. A., Shepard, S. A., Reiser, M., ... Guthrie, I. K. (2001). The relations of regulation and emotionality to children's externalizing and internalizing problem behavior. *Child Development, 72*(4), 1112–1134.

Eisenberg, N., Spinrad, T. L., & Eggum, N. D. (2010). Emotion-related self-regulation and its relation to children's maladjustment. *Annual Review of Clinical Psychology, 6*, 495–525. http://dx.doi.org/10.1146/annurev.clinpsy.121208.131208.

Eisenberg, N., Zhou, Q., Spinrad, T. L., Valiente, C., Fabes, R. A., & Liew, J. (2005). Relations among positive parenting, children's effortful control, and externalizing problems: A three-wave longitudinal study. *Child Development, 76*(5), 1055–1071.

Elliot, A. J., & Thrash, T. M. (2002). Approach-avoidance motivation in personality: Approach and avoidance temperaments and goals. *Journal of Personality and Social Psychology, 82*(5), 804–818. http://dx.doi.org/10.1037//0022-3514.82.5.804.

Elliot, A. J., & Thrash, T. M. (2010). Approach and avoidance temperament as basic dimensions of personality: Approach and avoidance temperament. *Journal of Personality, 78*(3), 865–906. http://dx.doi.org/10.1111/j.1467-6494.2010.00636.x.

Ellis, L. K., & Rothbart, M. K. (2001, April). Revision of the early adolescent temperament questionnaire. *Poster presented at the biennial meeting of the Society for Research in child development, Minneapolis, MN*.

Estonian Government (2011/2014). National curriculum for basic schools. https://www.riigiteataja.ee/en/eli/ee/VV/reg/524092014014/consolide.

Frick, P. J., Barry, C. T., & Kamphaus, R. W. (2010). *Clinical assessment of child and adolescent personality and behavior* (3rd edition). New York: Springer.

Georgiou, G. K., Manolitsis, G., Nurmi, J.-E., & Parrila, R. (2010). Does task-focused versus task-avoidance behavior matter for literacy development in an orthographically consistent language? *Contemporary Educational Psychology, 35*(1), 1–10. http://dx.doi.org/10.1016/j.cedpsych.2009.07.001.

Georgiou, G. K., Manolitsis, G., Zhang, X., Parrila, R., & Nurmi, J.-E. (2013). Examining the developmental dynamics between achievement strategies and different literacy skills. *International Journal of Behavioral Development, 37*(3), 173–181. http://dx.doi.org/10.1177/0165025413477007.

Hirvonen, R., Georgiou, G. K., Lerkkanen, M.-K., Aunola, K., & Nurmi, J.-E. (2009). Task-focused behaviour and literacy development: A reciprocal relationship. *Journal of Research in Reading, 33*(3), 302–319. http://dx.doi.org/10.1111/j.1467-9817.2009.01415.x.

Hirvonen, R., Tolvanen, A., Aunola, K., & Nurmi, J.-E. (2012). The developmental dynamics of task-avoidant behavior and math performance in kindergarten and elementary school. *Learning and Individual Differences, 22*(6), 715–723. http://dx.doi.org/10.1016/j.lindif.2012.05.014.

Hoffert, S., Pleck, J., Stueve, J., Bianchi, S., & Sayer, L. (2002). The demography of fathers: What fathers do. In C. Tamis-LeMonda, & N. Cabrera (Eds.). *Handbook of father involvement: Multidisciplinary perspectives* (pp. 33–62). Mahwah, NJ: Erlbaum.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1–55.

Jõgi, A.-L., & Kikas, E. (2016). Calculation and word problem-solving skills in primary grades - impact of cognitive abilities and longitudinal interrelations with task-persistent behaviour. *British Journal of Educational Psychology, 86*(2), 165–181. http://dx.doi.org/10.1111/bjep.12096.

Kikas, E., & Mägi, K. (2015). Transactional development of parental beliefs and academic skills in primary school. *Early Child Development and Care, 185*, 1148–1165. http://dx.doi.org/10.1080/03004430.2014.983095.

Kikas, E., Peets, K., & Hodges, E. (2014). Collective student characteristics alter the effects of teaching practices on academic outcomes. *Journal of Applied Developmental Psychology, 35*, 273–283.

Kikas, E., Tulviste, T., & Peets, K. (2014). Socialization values and parenting practices as predictors of parental involvement in their children's educational process. *Early Education and Development, 25*, 1–18.

Lengua, L. J., Bush, N., Long, A. C., Trancik, A. M., & Kovacs, E. A. (2008). Effortful control as a moderator of the relation between contextual risk and growth in adjustment problems. *Development and Psychopathology, 20*, 509–528. http://dx.doi.org/10.1017/S0954579408000254.

Liao, C.-H., Georgiou, G., Zhang, X., & Nurmi, J.-E. (2013). Cross-lagged relations between achievement strategies and literacy skills in Chinese. *Learning and Individual Differences, 25*, 73–79.

Liew, J. (2012). Effortful control, executive functions, and education: Bringing self-regulatory and social-emotional competencies to the table. *Child Development Perspectives, 6*, 105–111. http://dx.doi.org/10.1111/j.1750-8606.2011.00196.x.

Lindeman, J. (1998). *ALLU—Ala-asteen lukutesti [ALLU—reading test for primary school].* Turku: University of Turku, Centre for Learning Research.

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods, 1*(2), 130–149.

Mägi, K., Häidkind, P., & Kikas, E. (2010). Performance-approach goals, task-avoidant behavior and conceptual knowledge as predictors of first graders' school performance. *Educational Psychology, 30*, 89–106.

Mägi, K., Lerkkanen, M.-K., Poikkeus, A.-M., Rasku-Puttonen, H., & Nurmi, J.-E. (2011). The cross-lagged relations between children's academic skill development, task-avoidance, and parental beliefs about success. *Learning and Instruction, 21*(5), 664–675. http://dx.doi.org/10.1016/j.learninstruc.2011.03.001.

Mägi, K., Männamaa, M., & Kikas, E. (2016). Profiles of self-regulation in elementary grades: Relations to math and reading skills. *Learning and Individual Differences, 51*, 37–48. http://dx.doi.org/10.1016/j.lindif.2016.08.028.

Mägi, K., Torppa, M., Lerkkanen, M.-K., Poikkeus, A.-M., Rasku-Puttonen, H., & Nurmi, J.-E. (2013). Developmental profiles of task-avoidant behaviour and reading skills in grades 1 and 2. *Learning and Individual Differences, 23*, 22–31. http://dx.doi.org/10.1016/j.lindif.2012.09.011.

Mahatmya, D., Lohman, B., Matjasko, J., & Farb, A. (2012). Engagement across developmental periods. In S. Christenson, A. Reschly, & C. Wylie (Eds.). *Handbook of research on student engagement* (pp. 45–64). New York, Dordrecht, Heidelberg, & London: Springer.

McClelland, M. M., & Cameron, C. E. (2012). Self-regulation in early childhood: Improving conceptual clarity and developing ecologically valid measures. *Child Development Perspectives, 6*, 136–142. http://dx.doi.org/10.1111/j.1750-8606.2011.00191.x.

Merrell, K. W. (2000). Informant report: Rating scale measures. In E. S. Shapiro, & T. R. Kratochwill (Eds.). *Conducting school-based assessment of child and adolescent behaviors* (pp. 203–234). New York: Guilford Publications.

Metsapelto, R.-L., Pakarinen, E., Kiuru, N., Poikkeus, A.-M., Lerkkanen, M.-K., & Nurmi, J.-E. (2015). Developmental dynamics between children's externalizing problems, task-avoidant behavior, and academic performance in early school years: A 4-year follow-up. *Journal of Educational Psychology, 107*(1), 246–257. http://dx.doi.org/10.1037/a0037389.

Monahan, K. C., Steinberg, L., & Cauffman, E. (2009). Affiliation with antisocial peers, susceptibility to peer influence, and antisocial behavior during the transition to

adulthood. *Developmental Psychology, 45*, 1520–1530. http://dx.doi.org/10.1037/a0017417.
Mueller, R. O., & Hancock, G. R. (2008). Best practices in structural equation modeling. In J. W. Osborne (Ed.). *Best practices in quantitative methods* (pp. 488–508). Thousand Oaks, CA: Sage. http://dx.doi.org/10.4135/9781412995627.d38.
Muris, P., Mayer, B., van Lint, C., & Hofman, S. (2008). Attentional control and psychopathological symptoms in children. *Personality and Individual Differences, 44*, 1495–1505.
Muthén, L. K., & Muthén, B. O. (1998–2014). *Mplus user's guide.* Los Angeles, CA: Muthén & Muthén. Retrieved from http://www.statmodel.com/download/usersguide/Mplus%20Users%20Guide%20v6.pdf, Accessed date: 1 June 2015.
OECD (2014). Does homework perpetuate inequities in education? *PISA in focus*. *46*Paris: OECD Publishing. http://dx.doi.org/10.1787/5jxrhqhtx2xt-en.
OECD (2016). *PISA 2015 results (volume I): Excellence and equity in education.* OECD Publishinghttp://dx.doi.org/10.1787/9789264266490-en.
Onatsu, T., & Nurmi, J.-E. (1995). *The behavioral strategy rating scale (BSRS).* Helsinki, Finland: University of Helsinki.
Onatsu-Arvilommi, T., & Nurmi, J.-E. (2000). The role of task-avoidant and task-focused behaviors in the development of reading and…. *Journal of Educational Psychology, 92*(3), 478.
Roberts, B. W., Caspi, A., & Moffitt, T. E. (2001). The kids are alright: Growth and stability in personality development from adolescence to adulthood. *Journal of Personality and Social Psychology, 81*, 670–683.
Rothbart, M. K., Ahadi, S. A., Hershey, K., & Fisher, P. (2001). Investigations of temperament at three to seven years: The children's behavior questionnaire. *Child Development, 72*, 1287–1604. http://dx.doi.org/10.1111/1467-8624.00355.
Rothbart, M. K., & Bates, J. E. (2006). Temperament. In W. Damon, R. M. Lerner, & N. Eisenberg (Eds.). *Handbook of child psychology: Vol 3. Social, emotional and personality development* (pp. 99–166). (6th ed.). New York: Wiley.
Rothbart, M. K., & Hwang, J. (2007). Temperament and development of competence motivation. In A. J. Elliot, & C. Dweck (Eds.). *Handbook of competence and motivation*. New York: Guilford Press.
Rothbart, M. K., & Jones, L. B. (1998). Temperament, self-regulation and education. *School Psychology Review, 27*, 479–491.
Rudasill, K. M., Prokasky, A., Tu, X., Frohn, S., Sirota, K., & Molfese, V. J. (2014). Parent vs. teacher ratings of children's shyness as predictors of language and attention skills. *Learning and Individual Differences, 34*, 57–62. http://dx.doi.org/10.1016/j.lindif.2014.05.008.
Rueda, M. R., Checa, P., & Rothbart, M. K. (2010). Contributions of attentional control to socioemotional and academic development. *Early Education & Development, 21*, 744–764. http://dx.doi.org/10.1080/10409289.2010.510055.
Satorra, A., & Bentler, P. M. (2001). A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika, 66*, 507–514.
Seymour, P. H. K., Aro, M., & Erskine, J. M. (2003). Foundation literacy acquisition in European orthographies. *British Journal of Psychology, 94*, 143–174.
Silinskas, G., & Kikas, E. (2017). Parental involvement in math homework: Links to children's performance and motivation. *Scandinavian Journal of Educational Research*. http://dx.doi.org/10.1080/00313831.2017.1324901 (forthcoming, Published online 01 Jun 2017).
Snyder, H. R., Gulley, L. D., Bijttebier, P., Hartman, C. A., Oldehinkel, A. J., Mezulis, A., … Hankin, B. L. (2015). Adolescent emotionality and effortful control: Core latent constructs and links to psychopathology and functioning. *Journal of Personality and Social Psychology, 109*(6), 1132–1149. http://dx.doi.org/10.1037/pspp0000047.
Steinberg, L., Albert, D., Cauffman, E., Banich, M., Graham, S., & Woolard, J. (2008). Age differences in sensation seeking and impulsivity as indexed by behavior and self-report: Evidence for a dual systems model. *Developmental Psychology, 44*, 1764–1778.
Steinberg, L., & Monahan, K. C. (2007). Age differences in resistance to peer influence. *Developmental Psychology, 43*, 1531–1543.
Valiente, C., Lemery-Chalfant, K., Swanson, J., & Reiser, M. (2008). Prediction of children's academic competence from their effortful control, relationships, and classroom participation. *Journal of Educational Psychology, 100*(1), 67–77. http://dx.doi.org/10.1037/0022-0663.100.1.67.
Véronneau, M.-H., Hiatt Racer, K., Fosco, G. M., & Dishion, T. J. (2014). The contribution of adolescent effortful control to early adult educational attainment. *Journal of Educational Psychology, 106*(3), 730–743. http://dx.doi.org/10.1037/a0035831.
Wang, M.-T., Brinkworth, M., & Eccles, J. (2013). Moderating effects of teacher–student relationship in adolescent trajectories of emotional and behavioral adjustment. *Developmental Psychology, 49*(4), 690–705. http://dx.doi.org/10.1037/a0027916.
Webb, J. T. (2001). Mis-diagnosis and dual diagnosis of gifted children: Gifted and LD, ADHD, OCD, oppositional defiant disorder. In N. Hafenstein, & F. Rainey (Eds.). *Perspectives in gifted education: Twice exceptional children* (pp. 23–31). Denver: Ricks Center for Gifted Children, University of Denver.
Wheaton, B., Muthén, B., Alwin, D. F., & Summers, G. (1977). Assessing reliability and stability in panel models. *Sociological Methodology, 8*(1), 84–136.
Zhang, X., Nurmi, J.-E., Kiuru, N., Lerkkanen, M.-K., & Aunola, K. (2011). A teacher-report measure of children's task-avoidant behavior: A validation study of the Behavioral Strategy Rating Scale. *Learning and Individual Differences, 21*(6), 690–698. http://dx.doi.org/10.1016/j.lindif.2011.09.007.
Zhou, Q., Hofer, C., Eisenberg, N., Reiser, M., Spinrad, T. L., & Fabes, R. A. (2007). The developmental trajectories of attention focusing, attentional and behavioral persistence, and externalizing problems during school-age years. *Developmental Psychology, 43*(2), 369–385. http://dx.doi.org/10.1037/0012-1649.43.2.369.
Zhou, Q., Main, A., & Wang, Y. (2010). The relations of temperamental effortful control and anger/frustration to Chinese children's academic achievement and social adjustment: A longitudinal study. *Journal of Educational Psychology, 102*(1), 180–196. http://dx.doi.org/10.1037/a0015908.
Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory Into Practice, 41*, 64–70.