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## **Reading Comprehension Difficulty Is Often Distinct from Difficulty in Reading Fluency and Accompanied with Problems in Motivation and School Well-being**

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**Reading Comprehension Difficulty Is Often Distinct from Difficulty in Reading Fluency  
and Accompanied with Problems in Motivation and School Well-being**

**Abstract**

This paper examined if difficulty in reading comprehension (PISA) is distinct from difficulty in reading fluency and if the distinct types of reading difficulties are differently associated with learning motivation, school burnout, and school enjoyment. The participants were 1,324 Finnish ninth graders. Findings suggested that difficulties in reading comprehension are often distinct from difficulties in reading fluency. Three reading difficulty groups were identified: (1) *poor readers* with both fluency and reading comprehension difficulties (n = 46, 3.5 %), (2) *slow readers* with only fluency difficulties (n = 70, 5.3%), and (3) *poor comprehenders* with only reading comprehension difficulties (n = 88, 6.5%). The slow readers had low scores only in reading-related motivation. Poor comprehenders and poor readers reported low motivation also in math and science, as well as higher level of burnout and lower school enjoyment than typical readers. The findings were similar for boys and girls.

**Keywords:** fluency, comprehension, reading difficulty, motivation, school well-being

## Introduction

A considerable proportion of adolescents worldwide struggle with reading, including those in the most developed education systems [e.g., in the OECD Program for International Student Assessment (PISA), e.g., OECD, 2010a; OECD, 2016a]. Reading difficulties can have substantial effects; not only do they cause problems in academic achievement, but they are reportedly linked to problems in motivation and well-being (e.g., Bear, Minke, & Manning, 2002; Korhonen, Linnanmäki, & Aunio, 2014; OECD, 2016b). In this study, we investigate the links between reading difficulties, learning motivation, and school well-being. We focus on the end of comprehensive school because at that time adolescents are making important decisions in choosing educational paths where not only skills, but motivational factors and well-being are also of great importance. For planning of support, it would be pedagogically important to understand better the associations between the different reading skills, motivation, and well-being. We add to the current knowledge by investigating whether different types of reading difficulties in adolescence are distinct (reading comprehension vs. reading fluency) and whether they are differently associated with learning motivation and school well-being in Finland. In addition, we use PISA Reading tasks for the assessment of comprehension of written material (texts, graphs, figures, and tables), which provides a broader assessment than what is typically used for reading comprehension. It is also of interest that although PISA reading assessment has gained much attention world-wide, we have limited information on its association with reading fluency. Based on the simple view of reading (Florit & Cain, 2011; Gough & Tunmer, 1986, Kirby & Savage, 2008) we expect to find that reading comprehension skills are partially distinct from reading fluency and that they also have differential links to learning motivation and school well-being.

### Difficulties in Reading Fluency and Reading Comprehension

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Difficulties in reading fluency characterize dyslexia in transparent orthographies such as Finnish, in which decoding accuracy develops very quickly (e.g., Aro & Wimmer, 2003). In more opaque languages, such as English or French, reading difficulties are typically characterized by erroneous reading. Despite the ability to read accurately, reading speed of the readers with reading difficulty can be very slow in transparent orthographies. For example, Eklund, Torppa, Aro, Leppänen, and Lyytinen (2015) showed that Finnish eighth graders with reading difficulties had a reading speed similar to that of average third graders. Slow and erroneous reading has been shown to impact on reading comprehension in many orthographies, including English (Georgiou et al., 2009); Dutch (de Jong & van der Leij, 2002), Finnish (Torppa et al., 2016), Greek (Kendeou, Papadopoulou, & Kotzapolou, 2013), French (Megherbi, Seigneuric, & Ehrlich, 2006), and Turkish (Babayiğit & Stainthorp, 2011).

Difficulties in reading fluency and reading comprehension do not always coincide after the beginning phases of reading acquisition (Florit & Cain, 2011). After basic decoding becomes automatic and fluent, more resources can be allocated to comprehension processes and the impact of decoding on reading comprehension diminishes, whereas the effect of linguistic comprehension increases (for a review, see Florit & Cain, 2011). This dissociation can also be seen in distinct groups of children with reading difficulties; some experience difficulties in reading comprehension despite adequate decoding whereas some develop average reading comprehension despite their below average decoding skills (e.g., Cain, Oakhill, & Bryant, 2004; Catts, Adlof, & Weismer, 2006; Nation, Clarke, Marshall, & Durand, 2004; Stothard & Hulme, 1995; Torppa et al., 2007). Although the link between fluency and comprehension grows weaker towards adolescence (e.g., Cutting & Scarborough, 2006; Denton et al., 2011; Eason et al., 2013; Rasinski et al., 2005), it does not cease to exist (see Florit & Cain, 2011).

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Despite an accumulated body of work on the association of reading fluency and reading comprehension, more research on adolescents and on languages other than English is still needed (see Florit & Cain, 2011; Kendeou et al., 2013). In the present study, we will examine for the first time if discordance exists between difficulties in PISA reading and reading fluency. This is of great interest as the PISA reading test has become widely recognized and has gained influence in the global educational debate and education policy decisions. Despite the impact of PISA, empirical research including external measures is still scarce (see, however, Arnbak, 2012; Artelt, Schiefele, & Schneider, 2001; Rajchert et al., 2014; Torppa, Eklund, Sulkunen, Niemi, & Ahonen, 2017). There are only few studies on PISA reading that have examined links to basic reading skills. Artelt et al. (2001) reported that reading fluency was strongly correlated with PISA reading performance in a sample of 6,104 15-year-old German pupils; however, the authors used a time-limited cloze test of reading fluency that includes a strong comprehension component. In another more recent study from the same sample we report here, reading fluency explained only 14% of PISA reading (Torppa et al., 2017). This suggests that difficulty in PISA reading and reading fluency tasks may not always coincide.

### **Reading Difficulties, Motivation and School Well-Being**

The second aim of the present study is to examine whether reading difficulties are similarly linked to motivation and school well-being. Previous studies have suggested that reading difficulties are associated with motivational factors: lower reading motivation (e.g., Butkowsky & Willows, 1980; Guthrie & Klauda, 2016; Lee & Zentall, 2012; Morgan, Fuchs, Compton, Condray, & Fuchs, 2008; Wolters, Denton, York, & Francis, 2014), as well as lower general learning motivation and school well-being (Bear, Minke, & Manning, 2002; Korhonen et al., 2014). Motivational theories suggest that repeated failures in learning tasks are likely to promote task-avoidant achievement behaviour, i.e., the tendency to avoid

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challenges or give up when confronting difficulties, whereas positive experiences facilitate task-focused achievement behaviour (Dweck & Leggett, 1988; Guthrie & Klauda, 2016; Onatsu-Arvilommi & Nurmi, 2000). Achievement behaviour, in turn, is supposed to reflect inner motivational processes such as self-concept of ability (i.e., belief about one's own ability in task), and task values (i.e., how interesting, important, or useful one finds the task) that energize and direct behaviour (Eccles et al., 1983; Wigfield & Eccles, 2000). Empirical research has established a strong link between poor reading skills and low motivation, thereby supporting these theoretical notions. For example, pupils with reading difficulties are shown to have lower reading self-concept, to report more task-avoidant behaviour, and to display lower persistence than their peers when facing difficulties in a reading task (Butkowsky & Willows, 1980; Lee & Zentall, 2012). Struggling readers, on average, are shown also to read less and find reading less interesting than skilled readers (see a review by Mol & Bus, 2011).

Because of the importance of reading skills in all academic subjects, it is plausible that by adolescence, reading difficulties are highly correlated with learning motivation across school subjects and are also associated with how pupils experience their schooling in general. Although research on this topic among adolescents is still rare, some studies have focused on this link. Bear et al. (2002) found that pupils with reading and mathematical difficulties perceive their academic ability less favourably than their peers. Korhonen et al. (2014) showed that struggling readers are likely to report lower academic self-concept and higher levels of school burnout than average readers. Thus, reading problems are likely to add to the student's burden by intensifying exhaustion caused by study demands, a cynical stance towards school, and feelings of inadequacy in comparison to peers (Salmela-Aro, Kiuru, Leskinen, & Nurmi, 2009). Furthermore, reading difficulties are shown to lower one's positive emotions, for example school enjoyment (Hagenauer & Hascher, 2014). Even though

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these studies have provided important evidence for the link associating reading difficulties with learning motivation and school well-being, more research on this topic is needed. Most importantly, previous studies have used composite measures of reading difficulties and thus been unable to examine pupils with different types of reading difficulties.

It is also possible that gender moderate the link associating reading difficulties with learning motivation and school well-being. It has been shown, for instance, that girls have better reading skills (e.g., Clinton et al., 2014; Rajchert et al., 2014; Stoet & Geary, 2013, 2015) and they also hold a more positive self-concept for literacy than boys (e.g., Denissen, Zarrett, & Eccles, 2007; Eccles, Wigfield, Harold, & Blumenfeld, 1993; Hirvonen, Georgiou, Lerkkanen, Aunola, & Nurmi, 2010; Nurmi & Aunola, 2005). In contrast, girls seem to experience more school burnout (Salmela-Aro, Kiuru, & Nurmi, 2008), although boys have been shown to be overrepresented among cynical pupils (Salmela-Aro, 2014). Thus, it is plausible to expect gender differences both in prevalence of reading difficulties and levels of learning motivation and school well-being. Whether links between these factors are dependent from gender is an open question based on previous literature, and therefore part of the third research question of this article.

### **The Present Study**

The present study adds to the current knowledge on both the dissociation of reading comprehension and basic reading fluency, as well as how different reading difficulties are associated with learning motivation (self-concept in reading, task avoidant/focused behaviour, and task values in literacy, math, and science) and school well-being (school burnout and school enjoyment). School burnout and enjoyment were chosen as indicators of school well-being because they are important determinants of health, overall well-being (OECD, 2003), and depression (Salmela-Aro, Savolainen, & Holopainen, 2009). Finally, we will examine gender effects because previous research suggests that there may exist gender



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differences favouring girls in reading (e.g., Clinton et al., 2014; Rajchek et al., 2014) as well as in learning motivation measures (e.g., Denissen et al., 2007; Eccles et al., 1993; Hirvonen et al., 2010; Nurmi & Aunola, 2005).

The specific research questions of this study are as follows:

- 1) How often does poor reading comprehension performance co-occur with slow reading among Finnish adolescents?
- 2) Are adolescents with different types of reading difficulties different in reading-related learning motivation (self-concept in reading and task values related to literacy), in the more general learning motivation measures (task avoidance, task-focused behaviour, or task values related to math and science), and school well-being (school burnout and school enjoyment)?
- 3) Are there gender effects on reading difficulty prevalence, school motivation, or school well-being? Are reading difficulties similarly linked to learning motivation, and school well-being among boys and girls?

## Method

### Participants

The participants consisted of 1,324 Finnish-speaking ninth graders from 95 classrooms in Finland. The sample is a part of the Jyväskylä Longitudinal Study of Dyslexia, JLD (Lyytinen, Erskine, Hämäläinen, Torppa, & Ronimus, 2015). Special education classes or pupils attending Swedish-speaking schools were not included in the sample (Finland has two official languages, Finnish and Swedish. Swedish language speakers represent 5% of population). Each of the classrooms were thus Finnish-speaking lower secondary school classrooms that organize teaching in accordance with the national curriculum.

In Finland reading instruction starts when children enter school in August of the year they turn seven years. Due to the transparent orthography and high-quality instruction, most

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children learn to read during the first months in school and become fluent readers in grade 1. From grade 3 onwards all children are expected to be able to learn by reading short texts. Comprehensive school is the same for all till age 15-16 (grade 9) and follows a national curriculum. The pupils with reading difficulties receive special education in schools. Based on national statistics, in 2016-2017 intensified support was provided to 29% of pupils ([http://www.stat.fi/til/erop/2017/erop\\_2017\\_2018-06-11\\_tie\\_001\\_en.html](http://www.stat.fi/til/erop/2017/erop_2017_2018-06-11_tie_001_en.html)). The service includes, for example, intensified teaching from classroom teachers, small group or individualized teaching with special education teacher, and tailored study plans.

### Measures

Trained testers (university researchers or final-phase psychology master's students) carried out the assessments in classrooms during the spring term of grade 9.

**Reading comprehension.** Reading comprehension was assessed with PISA reading link items. These tasks are repeated in each PISA assessment cycle to ensure that the measurement is comparable across years (OECD, 2010b, p. 26; 2013, p. 45. In PISA, reading has been defined as understanding, using and reflecting on written texts (OECD 2009). Although half of the reading items in this study required short written responses, in scoring the written responses the quality of writing, organization or spelling have not been among the scoring criteria (OECD 2009, 2016c, p. 31). Thus, PISA is primarily a reading test although some ability to communicate thoughts in writing is required of the respondents. Pupils were asked to answer several questions based on eight different texts in a booklet. There were texts, tables, graphs, and figures in the reading materials. Of the 31 questions, 15 were multiple-choice questions, in which pupils had to pick up the correct choice from 2-4 alternatives. Sixteen of the questions required written response. There were 12 questions that required students to access and retrieve information, seven to reflect and evaluate information, and 12 to integrate and interpret information. There was a 60 minutes time limit

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to complete the task. A total score was calculated based on all 31 questions. Reliability for the total score in this sample was .80 according to Cronbach's alpha.

**Reading fluency.** Finnish orthography features a high degree of grapheme-to-phoneme regularity, both in feed-forward and feed-backward modes. Already in primary grades, struggling reading is identified as impaired word reading speed with accuracy being nearly perfect for most pupils (e.g., Seymour, Aro, & Erskine, 2003). In the present study, fluency was assessed with three tasks widely used in Finland, each one aiming at minimizing the reader's cognitive load. All the tasks are time limited (1.5 – 3 minutes) with scores based on the number of items correctly passed within the time limit. Two of the tasks, Error search task and Word chains, stress on fast decoding accuracy whereas the third task, Sentence reading, assesses the ability to fluently identify words in their natural context. (1) *Sentence reading*: The students were asked to read statements as quickly as possible and decide in each whether it was true or false. All sentences were short easy sentences and did not require specialized knowledge (e.g., A ball is round, or Blueberries are yellow). The score was calculated by subtracting the number of incorrect answers from the number of correct answers. (2) *Error search task*: The task was to proofread words and mark as many incorrectly spelled words as possible within the time limit of three minutes. Words were written on a sheet of paper and each word included one error (either a wrong letter, extra letter, or missing letter). The number of correct answers minus the number of incorrect answers within the three minutes time limit was used as the score. (3) *Word chains*: Altogether 25 items consisting of four words in a row and written together without any spaces in between were given to students in two sheets of paper. Students' task was to mark with a pencil as many word boundaries in each item as possible in 90 seconds. Number of incorrectly identified word boundaries were subtracted from the number of correctly identified word boundaries to achieve the score for this task. Arithmetic mean of standardized

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scores of the three reading tasks was used as the composite score for reading fluency.

Reliability for the reading fluency composite score was .78 based on Cronbach's alpha.

**Reading self-concept.** Pupils evaluated their reading skills in comparison to the peers. Three items were included: one for reading accuracy, one for reading fluency, and one for reading comprehension. A 3-point Likert scale was used: 1 = *I am better than my peers*; 2 = *I am as good as my peers*; and 3 = *I am not as good as my peers*. For analyses, the scale was transposed (1 = *I am not as good as my peers*; 2 = *I am as good as my peers*; and 3 = *I am better than my peers*). A composite score was created by computing a sum of the three items. Cronbach's alpha reliability coefficient was .75.

**Task avoidance and task-focused behavior.** Behaviours when approaching a new learning situation were assessed using a shortened version of the Achievement Beliefs Scale for Children (ABS-C; Aunola & Nurmi, 2006). Pupils evaluated nine statements in relation to typical thoughts and behaviours in academic situations on a 5-point scale (*1 = not true*, *5 = very much true*). Students' task avoidance measure was based on five statements regarding their behaviour when facing difficult tasks (e.g., "*When facing difficulties, I have a tendency to find something else to do instead of focusing on the task at hand*"). Cronbach's alpha reliability coefficient for the five items was .79. Student's task-focused behaviour measure was based on four statements regarding their attitudes when facing difficult tasks (e.g., "*I attempt to solve even difficult tasks*"). A composite score was created by computing a mean of the four items. Cronbach's alpha reliability coefficient for the four items was .71.

**Task values.** Task values (Eccles et al., 1983) were assessed by asking 18 questions regarding (1) how important, (2) how useful, and (3) how interesting pupils thought science, math, and literacy are as school subjects. Two questions were posed regarding each dimension of task values and the participants answered these questions separately for each of the three subjects on a 5-point scale (*1 = not at all*, *5 = very much*). Cronbach's alpha

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reliability coefficients were: importance of reading (.85), math (.85) and science (.86); utility of reading (.78), math (.75) and science (.74); and interest in reading (.85), math (.89) and science (.89).

**School burnout.** School burnout was assessed with the School Burnout Inventory (SBI, Salmela-Aro & Näätänen, 2005). The inventory consists of three subscales: exhaustion, cynicism toward the meaning of studying, and sense of inadequacy as a student. Exhaustion (e.g., *"I feel overwhelmed by my schoolwork"*) was measured with four items, inadequacy (e.g., *"I often have feelings of inadequacy in my schoolwork"*) with three items and cynicism toward the meaning of studying (e.g., *"I feel that I am losing interest in my school work"*) with three items. Participants rated items using 5-point scale (*1 = totally agree, ... 5 = totally disagree*). Composite school burnout score was computed by summing the subscores. The Cronbach alpha reliability for the composite score was .74.

**School enjoyment.** School enjoyment was assessed with three ABS-C (Aunola & Nurmi, 2006) items that measured pupils' typical thoughts and behaviour toward school and schoolwork (e.g., *"It is nice to come to school"*). A composite score was created by computing a mean of the three items; one negatively worded item was reversed. Cronbach's alpha reliability coefficient for the scale was .82.

### Analysis

Prior to analysis, all distributions of measures were inspected and found to approximate normal distribution. There were, however, five outliers in reading fluency measure (very slow readers) which were winsorized.

All group comparison analyses were run first using a 2 x 4 MANOVA with gender and reading difficulty grouping as between-level factors and school classroom membership as a random factor. Classroom membership was added as a random factor because the data were collected from classrooms and the effect of classroom membership on individual differences

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should be controlled. However, because there were no main effects for classroom and no significant interactions between reading groups, classroom membership, and gender, we report the one-way ANOVAs with only the reading group as a between-level factor. We also separately report gender differences. See Appendix Table 1 for Pearson correlation coefficients.

## Results

### Reading Difficulty Groups

Groups based on their skills in reading fluency (mean of standardized values of the three fluency tasks) and PISA reading (the composite score) were identified. We adopted a rather stringent cut-off score of the lowest 10% in order to select pupils with clear difficulties while retaining a reasonable group size. Based on the cross-tabulation of the dichotomized reading fluency and PISA reading, the following four groups were identified: (1) poor readers with both reading fluency and PISA reading in the lowest 10% ( $n = 46$ , 3.5%), (2) slow readers with only reading fluency in the lowest 10% ( $n = 70$ , 5.3%), (3) poor comprehenders with only PISA reading in the lowest 10% ( $n = 88$ , 6.5%), and (4) readers without difficulty ( $n = 1120$ , 84.6%). Thus, only one third (46 out of 134) of pupils with difficulties in PISA reading showed comparable difficulties also in reading fluency.

To describe the group differences in reading skills, we compared the groups using ANOVA (see Table 1 for descriptive statistics and F-test results and Appendix Table 2 for the effect sizes). As regards the raw scores, poor comprehenders and poor readers received half of the points in the PISA reading test, thus discriminating the groups in the area of reading comprehension. Slow readers and poor readers, on the other hand, were clearly slower in all reading fluency tasks than the poor comprehenders and typical readers. Slow readers and poor readers read correctly and verified in the 2 minute sentence reading task on average 22 and 23 sentences, respectively, while poor comprehenders scored 35 and typical

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readers 37 sentences; in error search poor readers identified 24 and slow readers 28 errors while poor comprehenders identified 53 and typical readers 60 errors in three minutes; in the word chain task poor readers marked 36 word boundaries and slow readers 38 while poor comprehenders marked 63 and typical readers 69 in 1.5 minutes.

According to the pairwise comparisons (Bonferroni corrected), the groups with single reading difficulty were as poor as the combined reading difficulty group in the deficient reading skill but did not match with typical readers in the non-deficient reading skill.

---INSERT TABLE 1 ABOUT HERE---

### Gender Differences

Comparison of the means in reading fluency and PISA reading showed that the difference between boys and girls was significant and around half a standard deviation (Table 2). There were also significant gender differences in learning motivation. Girls reported higher task values for literacy (interest, importance, and usefulness) and science subjects (importance and usefulness). Girls also reported higher school enjoyment and less cynicism but at the same time they reported more exhaustion. Boys were more interested in math than girls.

---INSERT TABLE 2 ABOUT HERE---

There was also a significant gender difference in allocation to reading groups ( $\chi^2(3) = 69.88, p < .001$ ). It was more common for boys, than girls, to be in any of the reading difficulty groups. Among boys, 6.3% were poor readers, as compared to 0.9% among girls (adj.stand.res. 5.3); 8.4% of boys were slow readers compared to 2.3% of girls (adj.stand.res. 4.9); 8.9% of boys were poor comprehenders compared to 4.5% of girls (adj.stand.res. 3.2);

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and 76.4% of boys were readers without difficulty compared to 92.2% of girls (adj. stand. res. 8.0).

### **Reading Difficulty Group Comparisons in Motivation**

Group differences (see Table 3 for descriptive data and F-test results; see Appendix Table 2 for the effect sizes) were significant for all learning motivation measures except for task-avoidant behaviour. According to the pairwise comparisons, reading self-concept and task value measures (interest, importance, and utility) for literacy were significantly lower in all reading difficulty groups than in the group without reading difficulty. The largest effect size emerged for the difference between slow readers and typical readers in reading self-concept. Low levels of task-focused behaviour and low task values concerning math and science were, however, found only among poor comprehenders and poor readers. Furthermore, poor comprehenders and poor readers reported significantly lower interest math and science than slow readers.

---INSERT TABLE 3 ABOUT HERE---

### **Reading Difficulty Group Comparisons in School Well-Being (School Burnout and School Enjoyment)**

Group comparisons in school well-being (see Table 3 for descriptive data and F-test results; see Appendix Table 2 for the effect sizes) also showed group differences. Both poor comprehenders and poor readers reported lower school enjoyment and more cynicism toward schoolwork than their peers without reading difficulties. Poor comprehenders reported more feelings of inadequacy and their total school burnout was more frequent than that among their peers without reading difficulties. Slow readers did not differ from typical readers in school burnout or school enjoyment.

## **Discussion**



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The present study examined reading fluency and comprehension difficulties, their comorbidity and associations with learning motivation and school well-being in a large Finnish sample of adolescents. We were particularly interested in whether reading comprehension and reading fluency difficulties are distinct and whether adolescents with different types of reading difficulties are different in their learning motivation and school well-being. We identified three reading difficulty groups based on a stringent criterion (slow readers with difficulties in reading fluency only; poor comprehenders with difficulties in reading comprehension only; and poor readers with difficulties in both) and compared group differences in concurrent learning motivation and school well-being measures. The results showed that, whereas the slow readers' learning motivation was compromised only in the reading-related domain (reading self-concept and task values for literacy), the poor comprehenders' and poor readers' problems in learning motivation spread more widely. Analysis revealed gender differences in skill levels and in certain motivation and school well-being measures, but no group x gender interaction. Lack of interaction suggests that reading difficulties were similarly linked to problems in learning motivation and school well-being among boys and girls.

**Distinctness of Reading Fluency and Reading Comprehension**

Our first question concerned the distinctness of difficulties in reading comprehension and reading fluency. As expected, the findings suggested a clear distinction; reading fluency and reading comprehension were not highly correlated ( $r = .42$ ) and difficulties co-occurred only for one fifth of the adolescents with reading difficulties. It is important to note that the reading difficulty groups with only a single deficit were as poor in their deficient reading skill as the poor readers' group. That is, having only a reading fluency or reading comprehension problem did not mean that the difficulty was less severe. In addition, the two groups with a single deficit differed clearly from each other in the deficient reading skill. These findings

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support the previous studies on the dissociation between reading fluency and reading comprehension (e.g., Cain et al., 2004; Catts, et al., 2006; Nation, et al., 2004; Stothard & Hulme, 1995; Torppa et al., 2007). The adolescents performing poorly in the reading comprehension task (PISA reading tasks) were not all slow readers, in fact most of them were not. The reason for their poor performance is something other than difficulties in decoding; slow readers can succeed in reading comprehension tasks. This finding is important for the interpretation of the PISA findings. PISA tasks are not tapping all types of reading although the results are often described simply as reading results.

These differences may emerge because the cognitive skills that are required to do well in these two types of reading tasks are different. Rapid automatized naming, for example, is a strong predictor of reading fluency (e.g., de Jong & van der Leij, 2002; Georgiou, Parrila, Manolitsis, & Kirby, 2011; Torppa et al., 2013). On the other hand, reading comprehension is better predicted by skills that require language comprehension, such as listening comprehension and vocabulary (for a review, see Florit & Cain, 2011). Furthermore, reading comprehension is also supported by more generic cognitive skills such as working memory (e.g., Cain et al., 2004; Georgiou et al., 2009), inference-making skills (e.g., Cain et al., 2004), and comprehension monitoring (e.g., Cain et al., 2004; Kinnunen, Vauras, & Niemi, 1998). It is notable that the cognitive predictors of reading fluency and reading comprehension are distinct already several years prior to school entry (e.g. Torppa et al., 2007). This suggests that the differentiation of reading fluency and reading comprehension does not originate from differences in reading teaching but rather from individual differences visible from early on. There are also indications that genetic influences on decoding and comprehension may work along partially independent paths (e.g., Betjemann et al., 2008; Harlaar et al., 2010; Keenan, Betjemann, Wadsworth, DeFries, & Olson, 2006; Olson et al., 2011).

**Reading Difficulties, Motivation, and School Well-Being**

By adolescence, the motivational factors become associated with reading skills; they may partially explain the skill differences or be outcomes of the poor skills (e.g., Logan, Medford, & Hughes, 2011; Retelsdorf, Köller, & Möller, 2011). In the present sample, it was common to all reading difficulty groups to report lower reading self-concept and lower task values related to literacy than typical readers did. This is in line with Eccles' expectancy-value theory, according to which earlier academic experiences and related feedback provide the basis for the development of one's beliefs about one's own skills and thus influence how one values different school subjects (Eccles et al., 1983; Eccles, Wigfield, & Schiefele, 1998). The development may proceed via various mechanisms. For example, feedback from teachers and peers in daily classroom situations affects pupils' understanding of their abilities (Eccles, 2005; Gottfried, 1990).

In addition to poor reading self-concept, all reading difficulty groups showed low interest in literacy and viewed literacy as less useful and important. Slow readers were as interested in math and science as typical readers, whereas both poor readers and poor comprehenders showed low learning motivation also in these subjects. These results suggest that if difficulties in reading fluency are not accompanied by reading comprehension problems, low motivation is not typically spread out to other domains. One possible explanation for this phenomenon is that reading comprehension is particularly important also for school subjects other than literacy, such as math and science. Furthermore, the skills supporting reading comprehension (e.g. working memory, inference-making skills, and comprehension monitoring) are relevant also to learning math and science.

Unlike slow readers, poor comprehenders and poor readers reported that they are less task-focused, like school less, and experience more school burnout (particularly feelings of inadequacy and cynicism). It is possible that learning difficulties, and therefore repeated

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failures, across the nine school years have had an influence on their feelings towards school and learning. Nevertheless, it is possible that their low motivation impacts on their task performance. In comparing the reading tasks, task focused behaviour is more important in typical reading comprehension tasks than in reading fluency because the former require longer periods of concentration and sustained effort (e.g. one hour in PISA reading versus few minutes at a time in the reading fluency tasks). It is possible that when pupils with low motivation face such tasks their effort levels differ from that of motivated pupils. They may be willing to work for a few minutes with an easy reading fluency tasks, whereas working for an hour on a challenging reading comprehension task can be too much. We cannot isolate the effect of differences in test requirements in this study, but the findings remind us to look carefully at what kind of test for reading is used in studies examining the link between motivation and reading (see also Keenan, Betjemann, & Olson, 2008). We should also consider this possibility when evaluating PISA results in each country as well as their correlations to other measures.

### **Gender Differences**

Finally, gender differences were of interest because previous studies have shown that girls typically have better reading skills (e.g., Clinton et al., 2014; Rajchert et al., 2014; Stoet & Geary, 2013, 2015) and higher learning motivation in literacy tasks (e.g., Denissen, et al., 2007; Eccles, et al., 1993; Hirvonen et al., 2010; Nurmi & Aunola, 2005), but they, in turn, may experience more school burnout than boys (Salmela-Aro, Kiuru, & Nurmi, 2008).. As expected, there were significant gender differences in favour of girls in reading skills, literacy motivation, and science motivation. Girls also enjoyed school more and were less cynical towards school work; on the other hand, girls reported more exhaustion and feelings of inadequacy than boys. These findings raise concern over boys' lag in reading and learning motivation and the reasons underlying the gap are of great interest. There is, however, an

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ongoing debate on the importance of the issue (e.g., Hyde, 2014; Watson, Kehler, & Martino, 2010; White, 2007) and we should note that not all studies have shown clear or meaningful gender differences in reading (e.g., Hyde & Linn, 1988; McGeown, Goodwin, Henderson, & Wright, 2012; White, 2007; Voyer & Voyer, 2014). It should also be noted that the rather small effect sizes suggest that the gap in this sample was not wide. The only exception was literacy motivation, where medium-range effect sizes emerged. For reading comprehension, effect size was small and for fluency it was medium. We see a clearer gender difference in the frequency distribution of reading difficulties. The probability of belonging to a reading difficulty group (scoring among lowest 10%) was more than three times higher for boys than for girls (23.6% versus 7.8%). Similar findings have been previously reported (see Quinn & Wagner, 2015; Stoet & Geary, 2013). The reasons for gender differences have been of interest in many fields of research and suggestions vary from biological maturation to cultural factors (e.g., Hyde, 2014; Watson, Kehler, & Martino, 2010; White, 2007).

**Limitations**

The main limitation of this study is the lack of longitudinal data and therefore the findings do not allow inferences on causal direction. In addition, having additional assessment points or external measures of reading skills would have allowed us to examine the subgroup identification reliability. Furthermore, we did not have measures of cognitive predictors of reading comprehension, such as memory or language skills, and thus potential cognitive underpinning of poor reading comprehension performance was not examined in this study. Future studies should also examine the effects of different supportive factors for learning motivation among the adolescents with reading difficulties, for example classroom characteristics and modes of interaction that support learning motivation (Pianta, Belsky, Vandergrift, Houts, & Morrison, 2008). Such studies should focus both on early and more advanced grades (see also Torgesen et al., 2007).

**Conclusions**

To conclude, our findings suggest that reading difficulties do not always co-occur and are not always linked to problems in learning motivation. The single reading fluency difficulty was linked only to reading-related learning motivation, while problems in reading comprehension were linked to lower task-focused behaviour in general, task values of math and science, as well as problems in school well-being. These findings challenge us to develop ways to identify and support adolescents with reading difficulties and learning motivation. In particular, the adolescents with poor comprehension who, by grade nine, report a lack of interest, utility, and importance concerning not only literacy but also math and science, can be at serious risk for dropping out of education.

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*Table 1*  
*Comparisons of the Reading Groups in Reading Measures*

|                              | Readers            |      |                    |      |                    |      |                    |      | F                    |
|------------------------------|--------------------|------|--------------------|------|--------------------|------|--------------------|------|----------------------|
|                              | without difficulty |      | Poor comprehenders |      | Slow readers       |      | Poor readers       |      |                      |
|                              | M                  | SD   | M                  | SD   | M                  | SD   | M                  | SD   |                      |
| PISA reading <sup>z</sup>    | 0.22 <sup>1</sup>  | 0.62 | -1.72 <sup>2</sup> | 0.43 | -0.23 <sup>3</sup> | 0.66 | -1.84 <sup>2</sup> | 0.55 | (3,1320) = 424.19*** |
| Reading fluency <sup>z</sup> | 0.22 <sup>1</sup>  | 0.70 | -0.17 <sup>2</sup> | 0.66 | -1.49 <sup>3</sup> | 0.41 | -1.69 <sup>3</sup> | 0.45 | (3,1320) = 245.94*** |

Note. <sup>z</sup> Standardized scores. The superscript numbers refer to paired comparisons (Bonferroni). The same superscript number means that the difference between the groups was not significant.

\*\*\*  $p < .001$

Table 2.  
Descriptive Statistics by Gender and *t* test Results

|                         | Girls    |           |          | Boys     |           |          | <i>t</i> -test |  | <i>d</i> |
|-------------------------|----------|-----------|----------|----------|-----------|----------|----------------|--|----------|
|                         | <i>M</i> | <i>SD</i> | <i>n</i> | <i>M</i> | <i>SD</i> | <i>n</i> |                |  |          |
| PISA reading            | 0.14     | 0.77      | 699      | -0.19    | 0.95      | 659      | 6.98 ***       |  | -0.38    |
| Reading fluency         | 0.23     | 0.80      | 715      | -0.29    | 0.87      | 697      | 11.80 ***      |  | -0.63    |
| Reading self-concept    | 6.02     | 1.15      | 675      | 5.99     | 1.26      | 649      | .43            |  | -0.02    |
| Task avoidant behaviour | 3.11     | 0.79      | 673      | 3.04     | 0.76      | 641      | 1.64           |  | -0.09    |
| Task-focused behaviour  | 2.82     | 0.74      | 673      | 2.88     | 0.74      | 641      | 1.70           |  | 0.09     |
| Task values: Literacy   |          |           |          |          |           |          |                |  |          |
| Interest                | 6.13     | 2.04      | 668      | 4.86     | 1.84      | 639      | 11.84 ***      |  | -0.66    |
| Importance              | 7.45     | 1.65      | 670      | 6.63     | 1.61      | 640      | 9.06 ***       |  | -0.50    |
| Utility                 | 7.24     | 1.77      | 667      | 6.23     | 1.86      | 639      | 9.97 ***       |  | -0.55    |
| Task values: Math       |          |           |          |          |           |          |                |  |          |
| Interest                | 5.16     | 2.23      | 671      | 5.45     | 2.21      | 640      | -2.43 *        |  | 0.13     |
| Importance              | 7.07     | 1.88      | 670      | 7.09     | 1.83      | 640      | -.22           |  | 0.01     |
| Utility                 | 6.64     | 1.91      | 667      | 6.70     | 1.88      | 639      | -.54           |  | 0.03     |
| Task values: Science    |          |           |          |          |           |          |                |  |          |
| Interest                | 5.83     | 1.86      | 669      | 5.66     | 1.90      | 639      | 1.57           |  | -0.09    |
| Importance              | 7.33     | 1.69      | 670      | 6.97     | 1.60      | 639      | 3.96 ***       |  | -0.22    |
| Utility                 | 6.35     | 1.69      | 667      | 6.05     | 1.68      | 637      | 3.21 **        |  | -0.18    |
| Burnout                 |          |           |          |          |           |          |                |  |          |
| Total sum               | 30.37    | 9.76      | 667      | 29.47    | 9.52      | 629      | 1.68           |  | -0.09    |
| Exhaustion              | 11.86    | 4.60      | 667      | 10.35    | 4.31      | 630      | 6.09 ***       |  | -0.34    |
| Cynicism                | 8.86     | 3.74      | 667      | 9.86     | 3.84      | 630      | -4.74 ***      |  | 0.26     |
| Inadequacy              | 9.64     | 3.65      | 667      | 9.23     | 3.44      | 629      | 2.06 *         |  | -0.11    |
| School enjoyment        | 3.27     | 0.94      | 673      | 2.90     | 0.93      | 641      | 7.16 ***       |  | -0.40    |

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

*Table 3*  
*Comparisons of the Reading Groups in Grade 9 Learning Motivation and School Well-being*

|                                | Readers           |      |                     |      |                     |      |                     |      | F                   |
|--------------------------------|-------------------|------|---------------------|------|---------------------|------|---------------------|------|---------------------|
|                                | without           |      | Poor                |      | Slow readers        |      | Poor readers        |      |                     |
|                                | difficulties      |      | comprehenders       |      |                     |      |                     |      |                     |
|                                | M                 | SD   | M                   | SD   | M                   | SD   | M                   | SD   |                     |
| <u>Reading self-concept</u>    | 6.12 <sup>1</sup> | 1.15 | 5.64 <sup>2</sup>   | 1.28 | 5.17 <sup>2</sup>   | 1.21 | 5.51 <sup>2</sup>   | 1.82 | (3,1248) = 18.77*** |
| <u>Task avoidant behaviour</u> | 3.07              | 0.77 | 3.12                | 0.83 | 3.07                | 0.80 | 3.12                | 0.92 | (3,1239) = 0.18     |
| <u>Task-focused behaviour</u>  | 2.91 <sup>1</sup> | 0.73 | 2.46 <sup>2</sup>   | 0.70 | 2.70 <sup>1,2</sup> | 0.73 | 2.58 <sup>2</sup>   | 0.77 | (3,1239) = 12.99*** |
| <u>Task values: Literacy</u>   |                   |      |                     |      |                     |      |                     |      |                     |
| Interest                       | 5.68 <sup>1</sup> | 2.07 | 4.64 <sup>2</sup>   | 1.74 | 4.80 <sup>2</sup>   | 1.65 | 4.84 <sup>2</sup>   | 1.74 | (3,1232) = 11.73*** |
| Importance                     | 7.24 <sup>1</sup> | 1.63 | 6.23 <sup>2</sup>   | 1.67 | 6.49 <sup>2</sup>   | 1.63 | 5.91 <sup>2</sup>   | 1.78 | (3,1235) = 20.83*** |
| Utility                        | 6.89 <sup>1</sup> | 1.86 | 6.18 <sup>2</sup>   | 1.90 | 6.27 <sup>1,2</sup> | 1.91 | 5.57 <sup>2</sup>   | 1.82 | (3,1232) = 11.92*** |
| <u>Task values: Math</u>       |                   |      |                     |      |                     |      |                     |      |                     |
| Interest                       | 5.37 <sup>1</sup> | 2.24 | 4.65 <sup>2</sup>   | 2.24 | 5.63 <sup>1</sup>   | 2.18 | 4.80 <sup>1,2</sup> | 2.08 | (3,1236) = 3.85**   |
| Importance                     | 7.23 <sup>1</sup> | 1.81 | 6.40 <sup>2,3</sup> | 2.01 | 7.00 <sup>1,2</sup> | 1.93 | 6.02 <sup>3</sup>   | 1.93 | (3,1235) = 10.68*** |
| Utility                        | 6.74 <sup>1</sup> | 1.85 | 6.18 <sup>2,3</sup> | 2.18 | 6.87 <sup>1,2</sup> | 1.95 | 5.84 <sup>3</sup>   | 1.96 | (3,1232) = 5.44**   |
| <u>Task values: Science</u>    |                   |      |                     |      |                     |      |                     |      |                     |
| Interest                       | 5.85 <sup>1</sup> | 1.83 | 4.92 <sup>2</sup>   | 1.96 | 6.00 <sup>1</sup>   | 2.33 | 5.14 <sup>1,2</sup> | 1.69 | (3,1233) = 8.54***  |
| Importance                     | 7.29 <sup>1</sup> | 1.60 | 6.40 <sup>2</sup>   | 1.68 | 7.02 <sup>1,2</sup> | 1.81 | 6.23 <sup>2</sup>   | 1.86 | (3,1235) = 12.88*** |
| Utility                        | 6.29 <sup>1</sup> | 1.66 | 5.67 <sup>2</sup>   | 1.93 | 6.31 <sup>1,2</sup> | 1.67 | 5.48 <sup>2</sup>   | 1.68 | (3,1230) = 6.51***  |

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| <u>Burnout</u>          |                    |      |                    |       |                      |      |                      |       |                     |
|-------------------------|--------------------|------|--------------------|-------|----------------------|------|----------------------|-------|---------------------|
| Total sum               | 29.48 <sup>1</sup> | 9.50 | 33.67 <sup>2</sup> | 11.00 | 29.96 <sup>1,2</sup> | 9.71 | 32.27 <sup>1,2</sup> | 10.49 | (3,1223) = 5.70**   |
| Exhaustion              | 11.10              | 4.52 | 11.78              | 4.89  | 10.74                | 4.34 | 10.92                | 4.61  | (3,1224) = .76      |
| Cynicism                | 9.09 <sup>1</sup>  | 3.74 | 11.36 <sup>2</sup> | 4.08  | 9.53 <sup>1,3</sup>  | 3.85 | 10.95 <sup>2,3</sup> | 4.25  | (3,1224) = 12.00*** |
| Inadequacy              | 9.29 <sup>1</sup>  | 3.55 | 10.52 <sup>2</sup> | 3.73  | 9.68 <sup>1,2</sup>  | 3.56 | 10.10 <sup>1,2</sup> | 3.74  | (3,1223) = 3.69*    |
| <u>School enjoyment</u> | 3.16 <sup>1</sup>  | 0.94 | 2.69 <sup>2</sup>  | 0.91  | 2.90 <sup>1,2</sup>  | 0.94 | 2.67 <sup>2</sup>    | 0.93  | (3,1239) = 10.66*** |

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Note. The superscript numbers refer to paired comparisons (Bonferroni). The same superscript number means that the difference between the groups was not significant. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

Appendix Table 1

*Pearson Correlation Coefficients between the Measures*

|                              | 1       | 2      | 3      | 4       | 5      | 6      | 7      | 8      | 9      | 10     | 11 | 12 | 13 | 14 |
|------------------------------|---------|--------|--------|---------|--------|--------|--------|--------|--------|--------|----|----|----|----|
| 1 PISA reading               | 1       |        |        |         |        |        |        |        |        |        |    |    |    |    |
| 2 Reading fluency            | .42***  | 1      |        |         |        |        |        |        |        |        |    |    |    |    |
| 3 Reading self-concept       | .26***  | .21*** | 1      |         |        |        |        |        |        |        |    |    |    |    |
| 4 Task avoidant<br>behaviour | -.10*** | -.02   | .15*** | 1       |        |        |        |        |        |        |    |    |    |    |
| 5 Task-focused<br>behaviour  | .29***  | .19*** | .28*** | -.45*** | 1      |        |        |        |        |        |    |    |    |    |
| <u>Task values: Literacy</u> |         |        |        |         |        |        |        |        |        |        |    |    |    |    |
| 6 Interest                   | .25***  | .23*** | .25*** | -.25*** | .32*** | 1      |        |        |        |        |    |    |    |    |
| 7 Importance                 | .27***  | .27*** | .24*** | -.24*** | .32*** | .60*** | 1      |        |        |        |    |    |    |    |
| 8 Utility                    | .19***  | .20*** | .18*** | -.17*** | .28*** | .55*** | .61*** | 1      |        |        |    |    |    |    |
| <u>Task values: Math</u>     |         |        |        |         |        |        |        |        |        |        |    |    |    |    |
| 9 Interest                   | .19***  | .04    | .12*** | -.39*** | .55*** | .31*** | .22*** | .23*** | 1      |        |    |    |    |    |
| 10 Importance                | .23***  | .15*** | .15*** | -.32*** | .48*** | .20*** | .53*** | .34*** | .66*** | 1      |    |    |    |    |
| 11 Utility                   | .19***  | .09*** | .12*** | -.24*** | .46*** | .22*** | .30*** | .42*** | .62*** | .67*** | 1  |    |    |    |
| <u>Task values: Science</u>  |         |        |        |         |        |        |        |        |        |        |    |    |    |    |

|    |                  |         |        |         |         |         |         |         |         |         |         |         |         |         |         |      |
|----|------------------|---------|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| 12 | Interest         | .24***  | .08**  | .22***  | -.32*** | .44***  | .48***  | .37***  | .32***  | .42***  | .34***  | .34***  | 1       |         |         |      |
| 13 | Importance       | .27***  | .17*** | .21***  | -.30*** | .40***  | .31***  | .66***  | .40***  | .28***  | .58***  | .37***  | .60***  | 1       |         |      |
| 14 | Utility          | .22***  | .13*** | .20***  | -.26*** | .42***  | .37***  | .43***  | .51***  | .36***  | .44***  | .52***  | .60***  | .61***  | 1       |      |
| 15 | Burnout          | -.21*** | -.06*  | -.15*** | .47***  | -.37*** | -.21*** | -.18*** | -.15*** | -.33*** | -.25*** | -.21*** | -.32*** | -.23*** | -.25*** |      |
| 16 | School enjoyment | .23***  | .18*** | .17***  | -.37*** | .40***  | .44***  | .37***  | .36***  | .39***  | .31***  | .30***  | .43***  | .35***  | .38***  | -.49 |

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

Appendix Table 2

*Effect Sizes for the Pairwise Group Comparisons*

|                                | Effect size <sup>a</sup>                             |  |  |   |   |                                     |
|--------------------------------|--|--|--|---|---|-------------------------------------|
|                                | No reading difficulties<br>vs.<br>Poor comprehenders | No reading difficulties<br>vs.<br>Slow readers | No reading difficulties<br>vs.<br>Poor readers | Poor comprehenders<br>vs.<br>Poor readers | Poor comprehenders<br>vs.<br>Slow readers | Poor readers<br>vs.<br>Slow readers |
| <u>PISA reading</u>            | <b>-3.64</b>   | <b>-0.71</b>                                   | <b>-3.52</b>                                   | -0.24                                     | <b>2.67</b>                               | <b>-2.65</b>                        |
| <u>Reading fluency</u>         | <b>-0.58</b>   | <b>-2.99</b>                                   | <b>-3.25</b>                                   | <b>-2.69</b>                              | <b>-2.40</b>                              | <b>-0.46</b>                        |
| <u>Reading self-concept</u>    | <b>-0.39</b>   | <b>-0.80</b>                                   | <b>-0.40</b>                                   | -0.08                                     | <b>-0.38</b>                              | -0.22                               |
| <u>Task avoidant behaviour</u> | 0.06   | 0.00   | 0.06   | 0.00                                      | -0.06                                     | -0.06                               |
| <u>Task-focused behaviour</u>  | <b>-0.63</b>   | -0.29  | <b>-0.44</b>                                   | 0.16                                      | <b>0.33</b>                               | 0.16                                |
| <u>Task values: Literacy</u>   |  |  |  |   |   |                                     |
| Interest                       | <b>-0.54</b>   | <b>-0.47</b>                                   | <b>-0.44</b>                                   | 0.11                                      | 0.09                                      | -0.02                               |
| Importance                     | <b>-0.61</b>   | <b>-0.46</b>                                   | <b>-0.78</b>                                   | -0.19                                     | 0.16                                      | <b>0.34</b>                         |
| Utility                        | <b>-0.38</b>   | <b>-0.33</b>                                   | <b>-0.72</b>                                   | <b>-0.33</b>                              | 0.05                                      | <b>0.37</b>                         |

Task values: Math

|            |              |       |              |       |             |             |
|------------|--------------|-------|--------------|-------|-------------|-------------|
| Interest   | <b>-0.32</b> | 0.12  | -0.26        | 0.07  | <b>0.44</b> | <b>0.39</b> |
| Importance | <b>-0.43</b> | -0.12 | <b>-0.65</b> | -0.19 | <b>0.30</b> | <b>0.51</b> |
| Utility    | -0.28        | 0.07  | <b>-0.47</b> | -0.16 | <b>0.33</b> | <b>0.53</b> |

Task values: Science

|            |              |       |              |       |             |             |
|------------|--------------|-------|--------------|-------|-------------|-------------|
| Interest   | <b>-0.49</b> | 0.07  | <b>-0.40</b> | 0.12  | <b>0.50</b> | <b>0.42</b> |
| Importance | <b>-0.54</b> | -0.16 | <b>-0.61</b> | -0.10 | <b>0.35</b> | <b>0.43</b> |
| Utility    | <b>-0.34</b> | 0.01  | <b>-0.49</b> | -0.11 | <b>0.35</b> | <b>0.50</b> |

Burnout

|            |             |       |             |       |              |              |
|------------|-------------|-------|-------------|-------|--------------|--------------|
| Total sum  | <b>0.41</b> | 0.05  | 0.28        | -0.13 | <b>-0.36</b> | -0.23        |
| Exhaustion | 0.14        | -0.08 | -0.04       | -0.18 | -0.22        | -0.04        |
| Cynicism   | <b>0.58</b> | 0.12  | <b>0.46</b> | -0.10 | <b>-0.46</b> | <b>-0.35</b> |
| Inadequacy | <b>0.34</b> | 0.11  | 0.22        | -0.11 | -0.23        | -0.12        |

School enjoyment

|  |              |       |              |       |      |      |
|--|--------------|-------|--------------|-------|------|------|
|  | <b>-0.51</b> | -0.28 | <b>-0.52</b> | -0.02 | 0.23 | 0.24 |
|--|--------------|-------|--------------|-------|------|------|

*Note.* Small ( $\geq .30$ ), medium ( $\geq .50$ ), and large ( $\geq .80$ ) effect sizes with bold. Effect sizes were estimated with Cohen's *d* computed using pooled standard deviation.



