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The role of reading difficulties in the associations between task values, efficacy beliefs, and achievement emotions

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Abstract

The aim of this study was to examine the situational associations of reading-related task values and efficacy beliefs with achievement emotions, and whether these associations are moderated by reading difficulties (RD). The sample comprised 128 Finnish sixth-grade students (66 with no reading difficulties [No RD], 31 with mild reading difficulties [Mild RD], and 31 with severe reading difficulties [Severe RD]) who were randomized to complete either a non-challenging or challenging reading task. Students reported their reading-related task values (attainment and interest) and efficacy beliefs right before and their achievement emotions both before and after performing the reading task. The results revealed that the associations of task values and efficacy beliefs with achievement emotions were moderated by RD and task difficulty. High attainment value was related to more positive and less negative emotions, especially for students with Severe RD. In turn, high interest value and efficacy beliefs were related to more positive emotions during the task, especially for students with No RD or Mild RD. Finally, among all students, higher interest value in the face of a non-challenging reading task and higher efficacy beliefs in the face of a challenging reading task were related to less negative emotions. The results provide a novel understanding of the role of RD in the situational associations between reading-related motivation and achievement emotions.

Keywords Achievement emotions · Early adolescence · Efficacy beliefs · Reading difficulties · Task values

There is a perpetual tendency in today's societies to place considerable emphasis on independency and individual achievements in school and professional life (OECD,

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2010; Pekrun, Goetz, Titz, & Perry, 2002). It often seems forgotten, however, that this gradual change in people's values may be unfavorable for those who struggle with academics, particularly reading skill development. Well-developed reading skills are among the most central basic human abilities, and they are greatly valued in society (Snow, Burns, & Griffin, 1998). They form an important basis for students' academic, social, and economic development (Savolainen, Ahonen, Aro, Tolvanen, & Holopainen, 2008: Snow et al., 1998; van der Leij & van Daal, 1999). However, reading difficulties (RD) are the most common type of learning difficulties (Kavale & Reese, 1992; Snow et al., 1998). Students dealing with RD often also experience problems with other school subjects (Koponen, Salmi, Eklund, & Aro, 2013; Light & DeFries, 1995; Willcutt & Pennington, 2000), and RD may have a negative influence on students' subsequent educational and vocational careers (Hakkarainen, Holopainen, & Savolainen, 2015).

To date, the field of research in reading and RD has put much emphasis on cognitive factors. Students' motivational and emotional experiences regarding their RD have been neglected almost entirely. More research is needed on different reading-related motivational aspects, such as task values (Baker & Wigfield, 1999; Chapman & Tunmer, 2003; Wolters, Denton, York, & Francis, 2014), and the emotions associated with reading experiences (Efklides & Volet, 2005; Pekrun & Linnenbrink-Garcia, 2012). Most of the previous studies have also focused on children at the beginning of their academic path, and less is known about the role of reading challenges among adolescents (Chapman & Tunmer, 2003; Eklund, Torppa, Aro, Leppänen, & Lyytinen, 2015).

In addition, as far as we know, no previous studies have investigated reading-related motivation and emotions in specific reading achievement situations. In real-time studies, it is possible to fairly directly assess participants' situational thoughts and beliefs that are not easily accessed by retrospective studies. Consequently, the aim of this study was to examine the situational associations of adolescents' reading-related task values and efficacy beliefs with achievement emotions in specific learning situations and whether these associations differ depending on the severity of RD.

Reading difficulties in early adolescence

Approximately 5–15% of school-aged children have a specific learning difficulty (American Psychiatric Association, 2013), and RD constitute the most prevalent type of these issues (Kavale & Reese, 1992; Snow et al., 1998). Reading challenges may appear as compromised decoding or reading comprehension skills, or both (Gough & Tunmer, 1986; Nation & Snowling, 1997; Seymour, Aro, & Erskine, 2003). In dyslexia research, *reading difficulties* have been defined as difficulties in fluent and/or accurate word recognition, decoding, and/or spelling skills, while problems in reading comprehension are seen as secondary (Lyon, Shaywitz, & Shaywitz, 2003). Poor decoding skills are maladaptive in that they are associated with reduced reading activities and thus may slow the growth of vocabulary and students' reading comprehension skills (Lyon et al., 2003). Fluent reading skills, however, facilitate

the release of resources for more high-level cognitive functions (Logan, 1997; Perfetti & Hart, 2001) needed in text comprehension.

Because of regular grapheme to phoneme correspondences, decoding skill is generally acquired quite effortlessly and quickly in transparent languages such as Finnish, compared to highly opaque languages like English (Aro & Wimmer, 2003; Seymour et al., 2003). In transparent languages, 80–90% of pseudowords are read correctly at the end of Grade 1, a level of accuracy not achieved by English readers before the end of Grade 4 (Aro & Wimmer, 2003). Therefore, reading fluency skills have usually been used as a criterion in measuring reading obstacles in transparent languages among all age groups (Lovett, Steinbach, & Frijters, 2000; Lyon et al., 2003; Torppa, Eklund, van Bergen, & Lyytinen, 2015). Accordingly, the classification of early adolescent students with RD in this study was based on their reading fluency.

Even though reading barriers have been given much scientific attention, most studies have focused on young children's reading skill development (Catts, Adolf, & Weismer, 2006; Torppa et al., 2015). However, students with reading problems are likely to continue struggling with their reading in later school grades and may, in fact, end up in a cumulative cycle of difficulties if they fall behind their classmates not only in reading-related skills but also in other subjects that involve reading. A history of issues with tasks involving reading may affect students' self-perceptions and emotions in subsequent situations. Moreover, the focus of most previous studies has been on the cognitive prerequisites of RD, that is, phonological awareness, rapid naming, and letter knowledge (e.g., Landerl et al., 2012; Ziegler et al., 2010). Much less attention has been given to how RD relate to adolescent students' motivation, efficacy beliefs, and emotions in reading-related situations.

The associations of task values and efficacy beliefs with achievement emotions among students with and without reading difficulties

Achievement emotions are associated with achievement-related activities or their outcomes (Pekrun, 2006, 2007). Achievement emotions can be categorized according to their object of focus as either *activity emotions*, representing present actions, or *outcome emotions*, representing the outcome of those actions (Pekrun, 2007; Pekrun, Elliot, & Maier, 2006). Besides their object focus and time perspective, achievement emotions can be classified according to their valence, ranging from positive to negative (Pekrun, 2007; Pekrun et al., 2006).

In the *Control–Value Theory of Achievement Emotions* (Pekrun, 2006; Pekrun & Perry, 2014), Pekrun et al. underscore two important factors influencing achievement emotions: (1) the subjective value of an achievement and (2) the experience of control over a task. More precisely, high control over a task and positive subjective value towards it have been associated with positive emotions (e.g., pride and enjoyment of learning), while poor control and negative subjective value have been linked to negative emotions (e.g., shame and hopelessness) (Pekrun et al., 2006). The Control–Value Theory and empirical evidence also highlight the subject-specificity of these control and value appraisals and emotions (Goetz, Frenzel, Pekrun, & Hall,

2006; Pekrun & Perry, 2014; Pekrun et al., 2002). Despite the growing attention to emotions in academic achievement situations, achievement emotions in reading have been studied only scarcely (Daley, Fischer, & Willett, 2014; Lupart, Cannon, & Telfer, 2004; Pekrun et al., 2006).

In this study, we investigated two types of reading-related task values as antecedents of reading-related achievement emotions: attainment and interest values, which are also central in Eccles' expectancy-value theory of achievement behavior (Eccles et al., 1983; Wigfield & Cambria, 2010; Wigfield & Eccles, 2000). What is fundamental to *attainment value* is that it describes the perceived importance of doing well on a task in terms of self-image (Eccles et al., 1983; Eccles, 2005). From the attainment value perspective, tasks that provide an opportunity for this or that are balanced with the individual's long-term goals are more valued than other tasks. *Interest value,* in turn, presupposes the enjoyment and liking of tasks related to a particular topic (Eccles, 2005). Interest has been associated with learning initiated by positive emotional experiences and curiosity (Eccles, 2005; Krapp, Hidi, & Renninger, 1992). Utility value, in turn, refers to the instrumental value of a task to reach other goals (Eccles et al., 1983; Eccles, 2005). Because attainment and interest values are assumed to be more closely related to self and emotions than utility value, we focused only on them in this present study, which investigated situational motivation and emotion in experimental reading achievement tasks.

Despite the growing scientific interest in the relationship between task values and achievement emotions, previous studies have rarely focused on the domain of reading. A few related studies have indicated that being interested in the topic of a reading task is associated with students' interest during the reading task and with their persistence to read (Ainley, Corrigan, & Richardson, 2005; Ainley, Hidi, & Berndorff, 2002). Selkirk, Bouchey, and Eccles (2010) studied the task values and achievement expectancies of sixth and seventh graders, and found that students experienced anxiety in reading situations if they valued the reading activities highly but did not expect to do well in the reading tasks.

In this study, we also investigated students' reading-related efficacy beliefs as antecedents of reading-related achievement emotions. Because competence beliefs refer to students' more general perception of their competence in a given domain, *efficacy beliefs* can be defined as students' expectation of what they can accomplish in a specific situation and task (Bandura, 1977; Bong & Skaalvik, 2003; Schunk & Pajares, 2002; Zimmerman, 2000; Wigfield & Cambria, 2010). In the present study, the focus was on reading tasks in specific learning situations. Thus, the concept of efficacy beliefs is used to refer to students' expectations of success in certain tasks. Efficacy beliefs not only reflect students' appraisal of their competence in a domain, but are also influenced by the context and circumstances (Bong & Skaalvik, 2003; Zimmerman, 2000).

Previous studies about the relationship between *efficacy beliefs* and reading-related achievement emotions are rare (e.g., Pekrun et al., 2002; Weiner, 1985, 2005). In general, students with low competence beliefs and a weak sense of self-worth have been found to experience positive emotions less often than other students (Seifert, 1995). In addition, studies focusing on maladaptive motivational styles (e.g., learned helplessness) relating to learning indicate that

students with reading obstacles typically experience negative emotions in association with low task motivation and low competence beliefs (Covington, 1984; Galloway, Leo, Rogers, & Armstrong, 1995, Galloway, Leo, Rogers, & Armstrong, 1996).

There is a call for more research about the relationship between reading-related task values, efficacy beliefs, and achievement emotions because the interplay between motivational and emotional factors can significantly contribute to students' effort in reading tasks and to what extent they can use their cognitive resources in developing their skills. A knowledge of these factors can help to draw attention not only to supporting the acquisition of reading skills but also to supporting the self-perceptions and emotional experiences of students with RD, ultimately aiming at their well-being at school. Reading challenges are usually identified during the early grades, and they tend to be persistent (Eklund et al., 2015; Landerl & Wimmer, 2008). Therefore, by Grade 6, the target of the present study, students with RD have had several opportunities to experience failure and poor performance in reading-related tasks compared to their peers. It is reasonable to assume that students with RD have experienced many negative emotions (Selkirk, Bouchey, & Eccles, 2010) and have acquired a negative attitude and low competence beliefs (Covington, 1984; Galloway et al., 1995, 1996) regarding reading tasks. There is some evidence supporting this line of thinking. However, little is known about the relationships between reading-related task values, efficacy beliefs, and achievement emotions, and whether they are dependent on the severity of RD or the difficulty level of the reading task. In other words, only a little is known about the role of reading obstacles as a possible moderator in these relationships. This present study is also unique in its examination of these relationships in a specific reading situation.

Aims and hypotheses

The objective of this study was to examine whether students' reading-related task values and efficacy beliefs are associated with their positive and negative emotions roused before and during a reading task, and whether these associations vary depending on: (1) whether students have reading issues and (2) whether the reading task is non-challenging or challenging. It was expected that students' low reading-related efficacy beliefs and low task values are related to a low occurrence of positive emotions and a high occurrence of negative emotions (Pekrun et al., 2006; Seifert, 1995). High task values regarding reading were expected to relate to frequently occurring high positive emotions (Pekrun et al., 2006). It was also hypothesized that the associations of task values and efficacy beliefs in reading are more strongly linked with negative reading-related achievement emotions among students with mild or severe reading impairments compared to students with no reading obstacles (Covington, 1984; Galloway et al., 1995, 1996). Given the lack of previous research, no specific hypotheses were set regarding the role of task difficulty.

Methods

Sample and procedure

This present study is part of a broader longitudinal study (N ~ 850), which aims to examine the risks and protective factors of Finnish students who face the transition from primary school to lower secondary school. The participants were from two municipalities in Central Finland. Both also included semi-rural areas with smaller schools. Written permission was requested from and granted by the parents and teachers to allow the students' participation. The study has been evaluated and approved by the ethics committee of the local university.

The present sample was drawn from the above-described larger community sample and comprised 128 sixth-grade students (53 girls, 75 boys) that participated in an experiment with a challenging and a non-challenging reading task. The sample was randomly selected based on students' reading fluency in Grade 6 (Fall), so half of the students had (n = 62) and half of the students did not have (n = 66) RD. Students scoring below the 16th percentile (approximately one standard deviation [SD] below the mean of the whole sample) were considered to have RD. Commonly, cut-offs in reading research are set to 1–1.5 SD below the mean of the population-based sample, being equivalent to 8–16% of the sample (e.g., Puolakanaho et al., 2007; Snowling, Callagher, & Frith, 2003).

The participant selection followed a hierarchical procedure. First, students whose native language was not Finnish or who scored lower than 3 SD below the age-level mean in the Raven standard progressive matrices were excluded. Second, 31 students were randomly selected and assigned to the Severe RD group from those who scored below the 8th percentile of the reading fluency composite score, that is, the arithmetic mean of the standardized scores from three reading tests—Wordchains, spelling errors, and sentence reading—described in more depth in the Measures section. Third, 31 students from those who scored between the lowest 8th and the 16th percentiles in reading fluency composite score were randomly selected and assigned to the Mild RD group. Finally, the No RD group was composed of 66 students with a reading fluency composite score above the 16th percentile by randomly selecting a representative student from the same classroom with a similar IQ (Raven matrices) to each of the students with RD (severe or mild). Consequently, three comparable groups were formed: *severe reading difficulties* (Severe RD, $N = 31$; 11 girls, 20 boys), *mild reading difficulties* (Mild RD, $N = 31$; 10 girls, 21 boys), and *no reading difficulties* (No RD, $N = 66$, 32 girls, 34 boys). There were no statistically significant differences between the groups in IQ (Raven matrices) or gender distribution (ps > .05).

In Grade 6 (Spring), the 128 subjects of this study participated in an individual assessment, including an experiment consisting of a challenging or a non-challenging reading task. The experiment's reading comprehension tasks were drawn from the nationally normed School Reading Test battery (Lindeman, 1998). The difficulty level of the tasks was individually adapted based on students' performance in the reading fluency tests performed earlier in Grade 6 (Fall). Half of the

students ($n = 64$) were randomized to complete a *non-challenging* reading task according to their own skill level, and the other half of the students (n = 64) were randomized to perform a *challenging* reading task according to their own skill level. Furthermore, randomization was undertaken so that half of the students in each RD group (No RD, Mild RD, Severe RD) were assigned the non-challenging task and the other half, the challenging reading task. The tasks lasted 4 min, and the students used a touchscreen computer to perform the task. The students also filled in short questionnaires before and after performing the reading task. Before the task, participants were told that the upcoming task was related to reading, but they did not receive any information regarding the task's difficulty level. The experiment was conducted during normal school hours in a campervan parked in the schoolyard, with a built-in ambulatory laboratory. During the individual tests with each student, there were two trained testers present.

At the beginning of the study, in fall 2014, the students were aged 11–13 years (M = 12.3 years, SD = 4.3 months). All of the students' mother tongue was Finnish, and two of them also had a second mother tongue. Approximately 74.2% of the students lived with both their mother and father, 9.4% with only their mother, and 10.9% alternated between both parents. Furthermore, 3.1% of the students lived with their mother and stepfather, 0.8% with their father and stepmother, and 1.6% in foster care or in an approved home. Concerning the education of the students' parents, 28.2% of the mothers and 21.9% of the fathers had a master's degree or other higher education, 17.2% of the mothers and 14.1% of the fathers had a vocational college degree, 35.9% of the mothers and 41.4% of the fathers had a vocational school degree, and 3.1% of the mothers and 7.8% of the fathers had no completed education or training beyond compulsory education. Additionally, 16 mothers and 18 fathers did not answer the question about their education. According to the students' living conditions and their parents' education, the sample can be concluded to be representative of the general Finnish population (Official Statistics of Finland, 2014; Official Statistics of Finland, 2015).

Measures

Students' reading fluency skills were tested in a group assessment at the beginning of the sixth grade. The data on reading-related task values, efficacy beliefs, and achievement emotions gathered during the experiment with challenging and non-challenging reading achievement tasks were collected in the spring of the sixth grade, using a computerized questionnaire that the students completed as part of the individual assessments. In addition, students filled in a questionnaire on achievement emotions immediately after completing either a challenging or non-challenging reading task.

Reading fluency (Grade 6, Fall)

Reading fluency was measured with three tests performed in a classroom setting: two tasks (searching for spelling errors and word chain checking) from the Word

Reading test (Holopainen, Kairaluoma, Nevala, Ahonen, & Aro, 2004) and the Sentence reading test (Landerl, Wimmer, & Moser, 1997; translated into Finnish by Sini Huemer).

The Word Reading test is part of the Finnish dyslexia screening test battery for youths and adults (Holopainen et al., 2004). The screening battery includes five tasks, two of which, Spelling errors and Word chains, were used in the current study. According to the test manual, data from a representative sample of Finnish ninth-grade students (n = 1846) were used to gain normative scores and to analyze the tests' psychometric properties. Test–retest reliabilities in two different schools have been reported to be adequate: .83 and .85 in Spelling errors and .70 and .84 in Word chains. The Word chains test was validated in another representative sample comprising 1719 ninth graders, where its correlation to the oral word reading task was .66 (Lerkkanen, Eklund, Löytynoja, Aro, & Poikkeus, 2018). In the same sample, the third reading test used in this study, the Sentence reading test was also validated. Its correlation to the oral word reading task was .69, suggesting that the Sentence reading test reliably measures word reading fluency. Unfortunately, no test–retest information is available concerning the Finnish version of the Sentence reading test, but according to the test manual, the reliability of the original Salzburg Sentence Reading test has been found to be good: .87 for eighth-grade students (Pichler & Wimmer, 2006).

In the *Spelling errors* test, the students had to find a spelling error in 100 misspelled words and mark the error with a slash. The words were written in their basic form, and there was one error in each word. Three error types were used: a missing letter (e.g., "käsitämätön"; correct form *käsit<u>t</u>ämätön* [incomprehensible]), an additional letter (e.g., "vauv<u>v</u>a"; correct form *vauva* [a baby]), and an incorrect letter (e.g., "kuulantyäntö"; correct form *kuulanty<u>ö</u>ntö* [shotput]). The number of correctly marked spelling errors minus misplaced slashes within the time limit of 3.5 min was used as the reading fluency score for this task. Cronbach's alpha reliability was .96 in the present study's sample.

The *Word chains* test consists of 25 word chains, each containing four words and, consequently, 100 separate words. Students were instructed to scan the unspaced word chains to identify the words and to mark word boundaries with slashes. The words were in their basic form and were written with no spaces in between (e.g., "vaatturimustikkavalmishevonen" [*tailorbilberryreadyhorse*]*)*. The number of correctly marked word boundaries minus misplaced slashes within the time limit of 1.5 min was used as the reading fluency score for this task. Cronbach's alpha reliability was .88 in this present study's sample.

In the *Sentence reading test*, a short version of the Salzburg Sentence Reading test (Landerl et al., 1997), the students were instructed to silently read 36 sentences one by one, and evaluate the truthfulness of each sentence by marking it as correct or incorrect. To focus on assessing reading fluency, the test is constructed so the truthfulness of a sentence is easy to conclude. Each correctly marked sentence earned one point. The number of correct answers within the time limit of 1.5 min was used as the reading fluency score for this task. Two versions of the test form (with identical sentences but in a slightly mixed order) were used to avoid copying answers from a classmate. The reliability of the original Salzburg Sentence Reading

test has been reported to be good, that is, .87 for eighth-grade students (Pichler & Wimmer, 2006). In the present study, Cronbach's alpha reliability was .90 for the sample.

Next, we standardized students' scores in all three reading tests, after which we calculated an arithmetic mean across students' scores in the three tests (α = .87). Using this standardized reading fluency composite score for the whole sample (n = 873), the participants of this study (n = 128) were selected in the hierarchical manner described in the Sample and Procedure section.

Difficulty in reading tasks (Grade 6, Spring)

The difficulty level of the reading tasks in the experiment was manipulated so half of the students (n = 64) were randomized to complete a non-challenging reading task and the other half of the students (n = 64) were randomized to perform a challenging reading task. The difficulty level of the tasks was individually adapted according to students' reading skill level (for a more detailed description, see Sample and Procedure). In the following analyses, the task type was coded "1" if the student performed a non-challenging reading task and "2" if the student performed a challenging reading task.

Reading values before the reading task (Grade 6, Spring)

Task values in reading were measured in the experiment using a computerized questionnaire that the students completed before performing the reading task they were assigned. Students' interest and attainment values were measured with an adapted version of the Task Values measure by Eccles and her colleagues (1983; see also Pesu, Aunola, Viljaranta, Hirvonen, & Kiuru, 2018). Both attainment value in reading (*How important do you think it is to do well in reading and writing tasks? How important is it for you to succeed in reading and writing?*) and interest value in reading (*How much do you enjoy doing reading and writing tasks? How much do you like reading and writing?*) were assessed with two questions on a five-point Likert scale ranging from 1 (*not important at all/very little*) to 5 (*very important/very much*). A mean score was calculated across two questions to measure students' attainment value (α = .89) and two questions to measure students' interest value (α = .85).

Efficacy beliefs before the reading task (Grade 6, Spring)

Efficacy beliefs prior to accomplishing the reading tasks were tested using questions adapted from measures by Eccles and Wigfield (1995) as well as Spinath and Steinmayer (2008). Students' efficacy beliefs were measured with two questions: *How well do you think you will succeed in the upcoming reading task?* and *How well do you think you will do compared to your peers?* The students answered the questions on a five-point Likert scale from 1 (*very poorly*) to 5 (*very well*). A mean score was calculated across the two questions to measure students' efficacy beliefs in reading (α = .80).

Anticipatory positive and negative emotions before the reading task (Grade 6, Spring)

Students' positive and negative anticipatory emotions towards the upcoming reading tasks were analyzed with the Emotions in Achievement Situations (EAS) scale (Kiuru, Eklund, Hirvonen, Kaartinen, Mikkonen, & Ahonen, 2014), which was adapted from the Achievement Emotion scale (AEQ; Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011) and the Positive and Negative Affect scale (PANAS; Watson, Clark, & Tellegen, 1988) to suit real-time achievement situations. From the AEQ, items that investigate students' academic emotions regarding learning, classes, and exams were drawn up with the aim of measuring academic emotions before, during, and after real-time achievement situations. The PANAS scale was also used as inspiration when formulating questions to suit real-time situations. The EAS scale, which investigated anticipatory emotions before reading tasks, included seven items that students were asked to evaluate by choosing the alternative they most agreed with according to their current affective state on a scale from 1 (*disagree*) to 5 (*agree*). A mean score for positive anticipatory emotions towards reading was calculated across the items measuring joy, hope, and enthusiasm ($\alpha = .80$). A mean score for negative anticipatory emotions towards reading was calculated across the items measuring anger/irritation, nervousness/restlessness, fear of failing, and hopelessness ($\alpha = .84$).

Positive and negative emotions during the achievement task (Grade 6, Spring)

Students' positive and negative emotions during their performance on the reading task were also measured with the Emotions in Achievement Situations (EAS) scale (Kiuru et al., 2014; see also Pekrun et al., 2011; Watson et al., 1988). Immediately after accomplishing the task, students rated eight items gauging their positive and negative emotions during the task according to a 5-point Likert scale ranging from 1 (*disagree*) to 5 (*agree*). A mean score for positive emotions during the reading task performance was calculated across the items measuring joy, hope, and enthusiasm ($\alpha = .75$). Moreover, a mean score for negative emotions during the reading task performance was calculated across the items measuring anger/irritation, nervousness/restlessness, panicky/anxiety, fear of failing, and hopelessness ($\alpha = .84$).

Statistical analyses

In this study, the aim was to examine the interrelationship between reading-related task values, efficacy beliefs, and achievement emotions of students with and without RD. The correlations between the independent variables (i.e., attainment value, interest value, and efficacy beliefs) were moderate (range .31–.68), suggesting that task values and efficacy beliefs were related but distinct constructs. No multicollinearity problems were observed, which was supported by the fact that the beta coefficients of the General Linear Models (GLM) were in line with the zero-order

correlations shown in Table 2. Moreover, the correlations between the independent variables did not significantly differ between the RD groups.

The statistical analyses were computed with the IBM SPSS Statistics 22 program and carried out according to the following steps. First, the distributions of the observed variables were explored. The distributions were fairly normal, except for negative emotions. Hence, negative emotion variables were logarithmically transformed before conducting further analyses. Second, general linear models were carried out to investigate the extent to which reading-related task values and efficacy beliefs predicted students' positive and negative emotions before and during non-challenging or challenging reading tasks, and whether these associations differed between the No RD, Mild RD, and Severe RD groups. The statistical significances of the interaction terms were explored first, and if needed, follow-up analyses were executed separately for students with No RD, Mild RD, and Severe RD, or for students who completed the non-challenging versus challenging task. The possible effects of student gender were controlled for in all the analyses.

Results

Table 1 shows the means and SDs of the observed variables. In addition, Table 2 depicts the correlations of interest and attainment values in reading and efficacy beliefs regarding the upcoming reading task with positive and negative achievement emotions for the whole sample and separately for students with No, Mild, or Severe RD. General linear models, separately for positive and negative emotions before and during the reading task, were conducted next to investigate the extent to which reading-related task values and efficacy beliefs predicted students' emotions before and during the non-challenging or challenging reading task, and whether these associations varied between students with No, Mild, or Severe RD.

Predicting positive emotions before the reading task

The results showed that RD did not moderate the associations of interest and attainment values and efficacy beliefs with positive emotions before the reading task. In other words, the related interaction terms (*interest value*×*RD, attainment value* × *RD,* and *efficacy beliefs*×*RD*) were non-significant. Consequently, the interaction terms were excluded, and the final general linear model only contained the main effects. The results also showed that an interest in reading was related to positive emotions before the reading task: $F(1, 122) = 10.39$, $p = .002$, partial $\eta^2 = .08$, observed power = .89, and efficacy beliefs in reading: $F(1, 122) = 18.09$, $p < .001$, partial $\eta^2 = .13$, observed power = .99. The more a student was interested in reading ($\beta = .32$, SE = 0.10; $t = 3.22$, $p = .002$) and the higher his or her efficacy beliefs in reading ($\beta = .32$, SE = 0.08; $t = 4.25$, $p < .001$), the more positive achievement emotions the student reported. The attainment value, the type of RD group, and gender had no unique main effects on overall positive emotions before the reading task (ps > .05).

Table 1 Descriptive statistics for students with no, mild, and severe reading difficulties (RD)

	All			(1) No RD			(2) Mild RD			(3) Severe RD		
	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Interest value before the reading task	128	3.04	0.82	66	3.17	0.80	31	2.83	0.81	31	3.00	0.85
Importance value before the reading task	128	3.60	0.75	66	3.77	0.61	31	3.39	0.87	31	3.45	0.82
Expected difficulty before the reading task	128	3.27	0.64	66	3.39	0.65	31	3.32	0.65	31	2.97	0.48
Efficacy beliefs before the reading task	128	3.38	0.60	66	3.41	0.64	31	3.23	0.56	31	3.47	0.55
Positive emotions before the reading task	128	3.47	0.86	66	3.51	0.82	31	3.31	0.75	31	3.53	1.05
Negative emotions before the reading task[a]	128	0.30	0.37	66	0.27	0.35	31	0.35	0.40	31	0.30	0.37
Positive emotions during the non-challenging reading task[b]	64	3.63	0.79	33	3.61	0.79	14	3.93	0.63	17	3.43	0.86
Negative emotions during the non-challenging reading task[a, b]	64	0.29	0.31	33	0.21	0.30	14	0.43	0.33	17	0.32	0.29
Positive emotions during the challenging reading task[b]	64	3.60	0.93	33	3.67	0.99	14	3.27	0.86	17	3.83	0.81
Negative emotions during the challenging reading task[a, b]	64	0.28	0.34	33	0.31	0.40	14	0.26	0.33	17	0.22	0.24

[a]Negative emotion variables are logarithmically transformed

[b]Half of the students completed the non-challenging reading task, and the other half of the students completed the challenging reading task adapted to their reading skill level

Table 2 Correlations of interest and attainment values in reading and reading-related efficacy beliefs with achievement emotions

Variable	Positive emotions								Negative emotions[1]							
	Before the reading task				During the non-challenging/challenging reading task[2]				Before the reading task				During the non-challenging/challenging reading task[2]			
	All	No RD	Mild RD	Severe RD	All	No RD	Mild RD	Severe RD	All	No RD	Mild RD	Severe RD	All	No RD	Mild RD	Severe RD
Interest value before a reading task	.56[a]	.58[a]	.46[c]	.59[a]	.45[a]/.36[b]	.54[b]/.40[c]	.45/.03	.45[d]/.59[c]	−.24[b]	−.22[d]	−.15	−.34[d]	−.31[c]/.03	−.31[d]/−.02	−.39/.23	.00/−.10
Attainment value before a reading task	.48[a]	.45[a]	.44[c]	.57[b]	.49[a]/.33[b]	.41[c]/.34[d]	.49[d]/.20	.71[b]/.56[c]	−.16[d]	−.05	−.04	−.50[b]	−.21[d]/.11	−.21/.20	−.05/.07	−.16/−.23
Efficacy beliefs before a reading task	.50[a]	.58[a]	.58[b]	.29	.42[b]/.59[a]	.31[d]/.78[a]	.83[a]/.23	.41/.13	−.43[a]	−.38[b]	−.43[c]	−.54[b]	−.19/−.47[a]	−.06/−.43[c]	−.21/−.63[b]	−.31/−.51[d]

[a]$p < .001$; [b]$p < .01$; [c]$p < .05$; [d]$p < .10$

[1]Negative emotions—measures are logarithmically transformed

[2]Half of the students completed the non-challenging reading task (n = 64), and the other half of the students (n = 64) completed the challenging reading task adapted to their reading skill level

Predicting negative emotions before the reading task

The results showed that RD did not moderate the associations of interest value and efficacy beliefs before a reading task. Hence, the related interaction terms (i.e., *interest value*×*RD* and *efficacy beliefs*×*RD*) were excluded from the final model. However, RD moderated the association of attainment value with negative emotions prior to the reading task, that is, the interaction term (*attainment value*×*RD*) was statistically significant: $F(1, 121) = 5.12$, $p = .025$, partial $\eta^2 = .04$, observed power = .61. The follow-up analyses indicated that, for students with Severe RD, a higher attainment value was related to fewer negative emotions prior to the reading task ($\beta = -.47$, SE = 0.15; $t = -3.14$, $p = .004$), whereas attainment value was not related to negative emotions among students with No RD ($\beta = -.05$, SE = 0.15; $t = -0.37$, $p = .71$) or Mild RD ($\beta = -.03$, SE = 0.17; $t = 0.20$, $p = .85$).

Furthermore, the results showed that efficacy beliefs—that is, $F(1, 121) = 23.98$, $p < .001$, partial $\eta^2 = .17$, observed power = 1.00—had a significant main effect on negative emotions before the task: The lower a student's efficacy beliefs in reading ($\beta = -.44$, SE = 0.09; $t = -4.90$, $p < .001$), the more negative achievement emotions the student reported. In turn, interest value and gender had no unique main effect on negative emotions before the reading task ($p > .05$).

Predicting positive emotions during the reading task

The results showed that the difficulty level of the reading task (non-challenging vs. challenging) did not moderate the associations of prior interest value, efficacy beliefs, expected difficulty, and RD with positive emotions during the reading task. Hence, the related interaction terms were excluded, and only the main effect of the difficulty of the reading task was included in the final general linear model. In turn, RD were found to moderate the association between attainment value before the reading task and positive emotions during the task, as well as the association between efficacy beliefs before the task and positive emotions during the task. In other words, the interaction terms of *attainment value*×*RD* group: $F(1, 117) = 4.23$, $p = .04$, partial $\eta^2 = .04$, observed power = .53 and *efficacy beliefs*×*RD* group: $F(1, 117) = 4.84$, $p = .03$, partial $\eta^2 = .04$, observed power = .59 were statistically significant. The follow-up analyses indicated that, for students with Severe RD, a higher attainment value was related to more positive emotions during the reading task ($\beta = .61$, SE = 0.24; $t = 2.58$, $p = .016$), whereas attainment value was not related to positive emotions among students with No RD ($\beta = .02$, SE = 0.16; $t = 0.11$, $p = .91$) or Mild RD ($\beta = .17$, SE = 0.19; $t = 0.88$, $p = .39$). Efficacy beliefs, in turn, were related to more positive emotions in students with No RD ($\beta = .52$, SE = 0.11; $t = 4.92$, $p < .001$) as well as in students with Mild RD ($\beta = .39$, SE = 0.19; $t = 2.01$, $p = .05$), whereas efficacy beliefs were not related to positive emotions during the reading task in students with Severe RD ($\beta = -.05$, SE = 0.19; $t = -0.20$, $p = .78$).

In addition, the results showed that, even though the *interest* value×*RD* interaction was not statistically significant ($p > .05$), interest was found to be marginally

significantly related to positive emotions during the reading task among students with No RD (β = .25, SE = 0.13; t = 1.88, p = .042), whereas interest was not related to positive emotions during the task among students with Mild RD (β = − .11, SE = 0.24; t = − 0.47, p = .65) or Severe RD (β = − .09, SE = 0.28; t = − 0.32, p = .75).

In turn, the difficulty level of the reading task (non-challenging vs. challenging) and gender had no unique main effects on overall positive emotions during the reading task (ps > .05).

Predicting negative emotions during the reading task

The results showed that the difficulty level of the reading task (non-challenging vs. challenging) moderated the associations of interest and attainment values, efficacy beliefs, and RD with negative emotions during the reading task. Specifically, the following interaction terms were statistically significant: *attainment value* × *RD group* × *task difficulty*: F(1, 114) = 5.43, p = .02, partial η^2 = .05, observed power = .64); *efficacy beliefs* × *task difficulty*: F(1, 114) = 4.39, p = .04, partial η^2 = .04, observed power = .55; and *attainment value* × *task difficulty:* F(1, 114) = 10.18, p = .002, partial η^2 = .08, observed power = .89. Consequently, the general linear models for negative emotions during the reading task were carried out separately for students who completed the non-challenging reading task (n = 64) and those who finished the challenging reading task (n = 64).

The results for students who completed the non-challenging reading task showed that RD did not moderate the associations of attainment and interest values, efficacy beliefs, and expected difficulty with negative emotions during the task. In other words, none of the related interaction terms were statistically significant. Furthermore, none of the main effects were statistically significant, except for the significant effect of interest in reading. Interest in reading was related to negative emotions: F(1, 55) = 4.63, p = .036, partial η^2 = .08, observed power = .56. The more interest a student reported in reading, the less negative emotions she or he reported during the non-challenging reading achievement task (β = − .44, SE = 0.20; t = − 2.15, p = .036).

The results for students who completed the challenging reading task were more diverse. The *attainment value* × *RD group* interaction was found to be statistically significant: F(1, 55) = 5.18, p = .027, partial η^2 = .09, observed power = .61. For students without RD, a high attainment value was related to a high level of negative emotions during the challenging reading task (β = .51, SE = 0.25; t = 2.2037, p = .032), whereas attainment value was not related to negative emotions during the task in students with Mild RD (β = .02, SE = 0.23; t = 0.86, p = .93) or Severe RD (β = − .198, SE = 0.40; t = − 0.44, p = .67). The results showed further that efficacy beliefs in reading had a main effect on negative emotions during the challenging reading task: F(1, 55) = 19.66, p < .001, partial η^2 = .26, observed power = .99. The higher the efficacy beliefs in reading a student had before the task, the less she or he experienced negative emotions during the task (β = − .59, SE = 0.13; t = − 4.34, p < .001). In turn, interest value prior to the reading task and gender had no unique main effects on negative emotions during the challenging reading task.

Additional analyses

We also carried out the additional general linear models to predict positive and negative emotions during the reading task when including positive/negative emotions before the task as the autoregressor in the analyses. In these analyses observed power to detect interaction terms was reduced below .50 but the pattern of results resemble those reported in the main analyses without the autoregressor.

Predicting positive emotions during the reading task

The results showed that positive emotions before the reading task had a significant main effect on positive emotions during the reading task: $F(1, 117) = 58.43$, $p < .001$, partial $\eta^2 = .33$. The higher the positive emotions in reading a student had before the task, the more she or he experienced positive emotions also during the task ($\beta = .62$, $SE = 0.08$; $t = 7.64$, $p < .001$). As reported previously without the autoregressor the results suggested that also after including the autoregressor in the model there was a tendency toward RD as a moderator of the association between attainment value before the reading task and positive emotions during the task (a p value of the interaction term *attainment value*×*RD* group = .049), as well as the association between efficacy beliefs before the task and positive emotions during the task (a p value of the interaction term *efficacy beliefs*×*RD* group= .07). The interpretation of the results was same as reported in the main analyses.

Predicting negative emotions during the reading task

The results showed that negative emotions before the reading task had a significant main effect on negative emotions during the reading task: $F(1, 113) = 116.24$, $p < .001$, partial $\eta^2 = .51$. The higher the negative emotions in reading a student had before the task, the more she or he experienced negative emotions also during the task ($\beta = .74$, $SE = 0.07$; $t = 10.28$, $p < .001$). As reported previously without the autoregressor the results suggested that also after including the autoregressor in the model there was a tendency toward that the difficulty level of the reading task (non-challenging vs. challenging) would moderate the associations of interest and attainment values, efficacy beliefs, and RD with negative emotions during the reading task (a p value of the interaction term *attainment value*×*RD group*×*task difficulty* = .10, a p value of the interaction term of *efficacy beliefs*×*task difficulty* = .15 and a p value of the interaction term *attainment value*×*task difficulty* = .048. Consequently, the analyses were carried out separately for students who completed the non-challenging reading task (n = 64) and those who finished the challenging reading task (n = 64). The interpretation of the results for both groups was same as reported in the main analyses.

Discussion

This study provides a novel understanding of the situational associations between reading-related task values and efficacy beliefs with achievement emotions among early adolescents with and without RD. The findings of the study showed that some of the associations of task values and efficacy beliefs with achievement emotions were moderated by the level of RD and task difficulty. For example, students' attainment value was related to more positive and fewer negative emotions, especially among students with Severe RD. In turn, students' interest value and efficacy beliefs were related to more positive emotions during the reading task, especially in the case of students with No RD or Mild RD.

Task values, achievement emotions, and reading difficulties

Our main aim was to examine whether reading-related task values and efficacy beliefs were associated with achievement emotions in reading situations and whether these associations varied depending on students' RD. Based on previous studies (Covington, 1984; Galloway et al., 1995, 1996; Pekrun et al., 2006; Seifert, 1995), we expected high task values and high efficacy beliefs to be related to more positive and fewer negative achievement emotions. In addition, we expected these relationships to show group-specific distinctions associated with the level of RD. The results were partly in line with these expectations.

The results for *attainment value in reading* revealed that the associations of attainment value with positive and negative emotions were moderated by RD. In line with our hypothesis, high attainment value was found to be associated with higher levels of positive emotions during a reading task and with lower levels of negative emotions before and during a challenging reading task, especially regarding students with Severe RD. In other words, attainment value was especially closely related to the achievement emotions of students with Severe RD. If they perceived success in reading as important, reading-related tasks aroused more positive and fewer negative emotions among them. In turn, if students with Severe RD did not value reading as important, the reading tasks led to fewer positive and more negative emotions among them. The low attainment value may reflect students' indifference to studying and further lead to lower levels of effort and even to the avoidance of challenges in academic tasks. If students have little confidence in their own abilities and they experience the fear of failure, then indifference and the withdrawal of their effort can serve them as a self-handicapping strategy in learning situations to avoid looking incompetent (e.g., Urdan, Midgley, & Anderman, 1998). Low effort and task avoidance, however, do not support the development of reading skills and can lead to harmful cycles of development (e.g., Aunola, Nurmi, Niemi, Lerkkanen, & Rasku-Puttonen, 2002; Hirvonen, Georgiou, Lerkkanen, Aunola, & Nurmi, 2010).

Overall, the results suggest that, when rehabilitating students with RD, it is important to pay attention to supporting students' attainment value as it is attributed to reading. Because of their severe challenges, these students may have acquired a negative or indifferent attitude towards reading, but if they learned to recognize the

importance of reading for their later educational and working careers, they might view the acquisition of reading skills at school to be more important. The values of parents, teachers, and peers influence attainment values. Thus, attention should be paid not only to how students themselves value reading tasks but also to how the importance of reading skills is discussed at home and in schools.

In turn, in the case of students with No RD, higher attainment value was found to be related to higher levels of negative emotions during the challenging reading task. This is in line with the Control–Value Theory, which suggests that if a student values a situation or its outcome highly but has no control over it, negative emotions such as frustration or hopelessness are likely to occur (Pekrun, 2006). It is possible that if students with No RD value reading skills as important for themselves and are used to doing well in reading tasks, then they also might experience more pressure to succeed in reading-related achievement situations. If they then face a difficult task that threatens their chances of succeeding, they may experience a heightened level of negative emotions.

In line with our hypothesis, the results for *interest value in reading* showed that a strong interest in reading was related to a higher level of positive emotions before a reading task among all students. Interest was also related to fewer negative emotions during the non-challenging reading task among all students. The results suggest that, among students with and without RD, reading material awakens fewer negative emotions when students are interested in reading and the material is not too challenging. Moreover, in previous studies, interest has frequently been linked to positive emotions (Krapp et al., 1992; Tsai, Kunter, Ludtke, Trautwein, & Ryan, 2008). Interest relates, for example, to experiences of curiosity and enjoyment of learning (e.g., Eccles, 2005). Interest in reading may be closely related to seeking new information and new experiences. Our results suggest that being interested in the task can help students to maintain a positive spirit in learning situations despite the possible hindrances students may have faced in previous situations. This highlights the importance of giving all students with any skill level the opportunity to work on school tasks that meet their interests and provide them a reasonable level of challenge.

Even though the *interest value*×*reading difficulties* interaction was not statistically significant, interest was also found to be significantly related to positive emotions during the reading task, especially for the students with No RD, but not for the students with Mild or Severe RD. It is possible that students with No RD who have more positive learning histories are, on average, more open to new experiences in the reading domain than students with a history of obstacles. Nevertheless, this marginal finding should be replicated in future studies.

Efficacy beliefs, achievement emotions, and reading difficulties

In terms of efficacy beliefs in reading, the results were partially in line with our hypothesis. The findings showed that the higher the students' efficacy beliefs in reading, the more they experienced positive reading-related emotions. This was in line with our hypothesis (Covington, 1984; Galloway et al., 1995, 1996; Pekrun

et al., 2006; Seifert, 1995) and with the *Control–Value Theory of Achievement Emotions* (Pekrun & Perry, 2014; Pekrun et al., 2006; Pekrun, 2006), which suggests that high perceived control (or competence/efficacy beliefs) precedes positive emotions (e.g., joy, hope) and the lack of negative emotions (e.g., hopelessness). In addition, in line with our expectation, the results showed that the strength of the association between efficacy beliefs and positive emotions during a reading task was moderated by RD. For students with No RD or Mild RD, higher efficacy beliefs were related to higher levels of positive emotions during a reading task. In turn, for students with Severe RD, efficacy beliefs were not related to positive emotions during a reading task. Thus, in the case of students with Severe RD, efficacy beliefs in the reading task seemed to be less important than reading-related attainment value in the arousal of positive emotions during the task. It is possible that, because of their history of challenges in reading, students with Severe RD do not perceive reading tasks as pleasant, even when they actually expect to do well in them. An alternative explanation is that these students' expectations of success before the task may contradict what they actually can achieve in it. This contradiction results in a lack of positive emotions during the task.

Efficacy beliefs and negative emotions were also significantly associated with each other regardless of students' level of RD. Higher efficacy beliefs were related to lower levels of negative emotions before and especially during a challenging reading task. No similar associations were found for students who completed the non-challenging task. Thus, it seems that a certain level of challenge is needed in a task before students' efficacy beliefs play a role in their experience of negative emotions. Feelings of competence and mastery further decrease the likelihood of negative emotions, since students with such self-beliefs may feel that they were in control of the situation. Negative emotions such as frustration and hopelessness are more likely to occur when a student feels that he or she has no control over a particular situation and its outcome (Pekrun, 2006).

Limitations, future directions, and conclusions

Despite the new knowledge gained on the relationship of task values, efficacy beliefs, and academic emotions among students with and without RD, this study is not without limitations. First, the sample size was relatively small ($N = 128$), which poses limitations regarding its statistical power. The power analyses showed that the observed power for the main effects was high (range .75–1.00). In turn, the observed power for the interaction effects was lower (range .54–.70), but still satisfactory, given the relatively small sample size. The magnitude of all effect sizes also ranged from moderate to large. Overall, the effects discerned from this investigation can be considered plausible. However, it is possible that more effects would have been found if the sample size was larger. Consequently, an important future direction is to investigate similar research questions with larger sample sizes.

Second, although this study investigated students' achievement emotions before and during reading tasks, these emotions were only examined regarding their valence (i.e., positive and negative emotions). In future studies, it would

be valuable to investigate the potentially differential roles of emotions that vary also to the extent that they activate or deactivate action (Carver & Harmon-Jones, 2009; Pekrun, 2006). Future studies are needed to reveal more complex dynamics of RD, learning motivation, and distinct academic emotions.

Third, the present study investigated the associations of reading-related task values, efficacy beliefs, and achievement emotions in specific achievement situations that were not authentic classroom situations. Novelty and excitement regarding the specific achievement situation, where each student was assessed individually, might have affected the emotional experiences of the students, compared to classroom situations where students study together with familiar classmates and teachers in larger groups. In the future, it would be important to investigate similar mechanisms also in actual classroom situations, as well as across academic activities that last longer than the situations investigated in the present study.

Finally, despite revealing an interesting pattern of results in real-time achievement situations, it is notable that the present study was cross-sectional and relied on a theoretical assumption that task values and efficacy beliefs precede academic emotions. It is possible, however, that it is the emotions that precede task values and efficacy beliefs in learning situations. In the future, cross-lagged longitudinal studies are needed to investigate more complex causal dynamics between task values, efficacy beliefs, and academic emotions among students with and without RD. Moreover, it would also be important to attempt to design intervention studies that would examine whether it is possible to enhance students' reading skills by influencing either their task values or efficacy beliefs, through subsequently promoting their more positive emotional experiences with reading tasks.

Overall, this study contributes to the understanding of adolescents' RD and their role in task values, efficacy beliefs, and achievement emotions. The research tradition in RD is multi-faceted and has a long history, but studies focusing on motivational and particularly emotional perspectives of the phenomenon are limited. In addition, most of the previous studies have focused on one related variable at a time, and the associations of distinct aspects of motivation, efficacy beliefs, and emotions have not been sufficiently examined. In this study, we examined how these variables are connected. Furthermore, our results showed how important it is not to treat all students with RD identically, but as individuals with different motives and beliefs as well as divergent reading skills. By defining RD as Mild or Severe, we were able to show that the level of severity was associated with the motivational and emotional experiences of the students. Considering the diversity of RD and their continuous development throughout an individual's lifespan, as well as the challenges typical of academic life during adolescence, more studies dedicated to the characteristics of adolescents' RD are needed.

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