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Profiles of school motivation and emotional well-being among adolescents: Associations with math
and reading performance

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Abstract

This study examines profiles of school motivation and emotional well-being and their links to academic skills (reading and math) among adolescents ($N = 1,629$) at the end of comprehensive school (age 15–16). Using a person-centered approach (latent profile analysis), five distinct profile groups were identified. Three of the identified groups had a flat profile in motivation and well-being but at different levels. The first group manifested high motivation and well-being ($n = 178$, 11%); the second group was average in both ($n = 1,107$, 68%); and the third had low motivation and well-being ($n = 121$, 7%). Two groups had mixed profiles; one group manifested only low motivation ($n = 140$, 9%) and the other only low well-being ($n = 83$, 5%). A comparison of the profile groups in terms of academic skills indicated that low school motivation was linked to poor math and reading performance, whereas low emotional well-being was linked to poor math and reading performance only when accompanied by low school motivation. The association between poor math skills and low motivation suggests that, when planning support for students, those with math problems or comorbid math and reading problems are especially at risk for low motivation and need support in both academic skills and motivation.

Keywords: math and reading performance, academic skills, emotional well-being, school motivation, person-centered approach

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1. Introduction

Many adolescents struggle with the key academic skills of math or reading (Dirks, Spyer, van Lieshout, & Sonnevillie, 2008). Developmental difficulties in cognitive functions typically underlie poor performance in academic learning. However, low school motivation, such as low task-focused behavior (Klauda & Guthrie, 2015) and low emotional well-being, such as low self-esteem (Nathan & Rucklidge, 2011), are also associated with poor academic performance. Previous studies on the links between difficulties with math and reading and school motivation and emotional well-being are limited. Furthermore, those studies typically focus on only a few aspects of those dimensions and on whole-sample averages and correlations, instead of using person-oriented approaches that allow for analysis of heterogeneous profiles in the sample. Profiling studies are pertinent because the links between math and reading difficulties, school motivation, and emotional well-being are likely to vary among individuals (Korhonen, Linnanmäki, & Aunio, 2014; Roeser, Eccles, & Sameroff, 1998). Profiling of several aspects simultaneously provides a more comprehensive understanding of the mechanisms for the accumulation of risks, identifies adolescents at the highest risk, and thus aids in building support systems. The present study includes a broad array of measures, ranging from academic skills (math, reading fluency, and reading comprehension), to school motivation (math motivation, literacy motivation, task-focused behavior, and school enjoyment) and emotional well-being (school burnout, self-esteem, and internalizing and externalizing behavior problems). In addition, it examines a large sample of adolescents at the end of comprehensive school, just before they transition to post-comprehensive secondary education.

1.1. Students' school motivation and academic performance

Theories of motivation and related empirical research indicate that motivation plays an important role in students' learning and academic achievement in school (Eccles & Wigfield, 2002;

Pintrich, 2003; Wigfield & Cambria, 2010). One approach to studying students' motivation in a particular learning situation focuses on strategies that students employ; that is, how one interprets the situation based on one's past experiences (Norem & Cantor, 1986; Nurmi, 1993; Wigfield et al., 2015), and what kind of response style one chooses, such as whether one approaches or avoids the learning task (Dweck, Chiu, & Hong, 1995; Onatsu-Arvilommi & Nurmi, 2000). The evidence indicates that task-focused behavior is related to better learning outcomes than task-avoidance (e.g., deep rather than surface processing; Elliot, McGregor, & Gable, 1999). According to the expectancy-value theory (Eccles, 2005; Eccles-Parsons et al., 1983; Wigfield & Cambria, 2010; Wigfield & Eccles, 1992, 2000), an individual's performance, persistence, and task choice in learning situations (i.e., achievement motivation) is influenced by his or her expectations and values. The theory proposes that a student is likely to engage in academic activities if the outcome is something he or she values as interesting (intrinsic enjoyment value), useful (utility value), and important (attainment value), and the effort the activity requires is suitable (relative cost). Motivation has also been associated with emotions (enjoyment) toward studying and school, where one's emotions impact the student's achievement at school via control and value cognitions (Hagenauer & Hascher, 2014; Pekrun, 1992, 2006, 2009). The link between motivation and achievement is assumed to form a reciprocal feedback system in which motivation increases enjoyment and academic achievement in the task domain (Goetz, Frensell, Hall, & Pekrun, 2008), and high achievement in school, in turn, increases experiences of high task value and school enjoyment via the self-concept of ability (Hagenauer & Hascher, 2014).

Although poor academic skills and math and reading difficulties are acknowledged as constituting risks toward the development of school motivation (Jögi, Kikas, Lerkkanen, & Mägi, 2015; Klaua & Guthrie, 2015; Onatsu-Arvilommi & Nurmi, 2000), studies on school motivation among children and youth with low math or reading performance remain scarce. High motivation for school subjects and task-focused behavior have been suggested to predict achievement more strongly among competent reading children than among struggling readers, even when effort and

persistence in a task are controlled for (Klauda & Guthrie, 2015). Poor academic skills have also been shown to affect behavioral strategies in learning situations by decreasing task-focused behavior during the first school years (Onatsu-Arvilommi & Nurmi, 2000). An important limitation of most previous studies is their narrow focus on only one motivational aspect at a time. In the present study, a more comprehensive approach is adopted by examining simultaneously students' behavioral strategies in learning situations (task-focused behavior), the value students attach to different school subjects (task values in math and in literacy), and students' emotions regarding school (school enjoyment).

1.2. Students' emotional well-being and academic performance

In addition to motivation, students' emotional well-being at school is important for their learning and academic achievement (Djambazova-Popordanoska, 2016). Instead of the overall meta-construct of well-being that covers diverse aspects of healthy and successful living (e.g., Renshaw, Long, & Cook, 2015), we focus on students' emotional well-being, conceptualized as an affective subjective experience and encompassing areas such as mood and self-esteem (Schutte, Malouff, Simunek, McKenley & Hollander, 2002). In the present study, adolescents' emotional well-being at school is conceptualized and assessed using the following four indicators: students self-reported school burnout, self-esteem, and externalizing and internalizing behavior problems.

School burnout is operationalized similarly to the construct of work-related burnout, but it is situated in the context of an individual's personal feelings about schoolwork. School burnout is seen to comprise the following three components (Salmela-Aro, Kiuru, Leskinen, & Nurmi, 2009): exhaustion (i.e., strain and fatigue because of schoolwork); cynical attitude toward school (i.e., detached attitude concerning studying); and a sense of inadequacy (i.e., diminished feelings of competence in school and schoolwork). School burnout can also be generalized outside the school context through depression (Salmela-Aro et al., 2009; Salmela-Aro & Upadyaya, 2014). Exhaustion and a sense of inadequacy can be manifested by a low positive mood and perception of oneself,

whereas a cynical attitude is directed towards school (Bask & Salmela-Aro, 2013). School burnout has been shown to be associated with academic skills (Salmela-Aro, 2009).

Self-esteem refers to an individual's global sense of well-being (Zeke, 2004) and reflects how much a person likes, accepts, and respects him- or herself overall as a person (Harter, 1990; Rosenberg, 1965). Self-esteem is central to maintaining both overall well-being and life satisfaction (Diener & Diener, 1995; Neto, 1993), and emotional well-being (Schutte et al., 2002). Self-esteem supports academic achievement by fostering belief in oneself as a learner (see Terras, Thompson, & Minnis, 2009), and low self-esteem has been correlated with low academic skills (Nathan & Rucklidge, 2011).

Emotional well-being can be also conceptualized as the absence of *externalizing and internalizing behavior problems*. The former refers to conduct problems and aggressive and impulsive behavior, and the latter refers to withdrawal, depression, anxiety, and somatic problems (Achenbach & Edelbrock, 1978). According to the literature, both externalizing behavior (Adams, Snowling, Hennessy, & Kind, 1999; Gresham, Lane, MacMillan, & Bocian, 1999; Hinshaw, 1992), and internalizing behavior (Greenham, 1999; Willcutt & Pennington, 2000) are consistently documented to be correlated with low academic skills. Previous studies have shown that the level of internalizing and externalizing behavior is higher among students with reading or math difficulties in comparison to typical learning peers (e.g., Arnold et al., 2005; Nathan & Rucklidge, 2011; Undheim, Wichstrøm, & Sund, 2011). The findings of the complex interrelationships between motivation, well-being, and academic skills provide an impetus for investigating motivation and well-being profiles separately for low math and low reading performance.

1.3. Person-centered studies on the relationships between motivation, well-being, and academic performance

In person-centered approaches, the focus is on individual differences and similarities, or profiles, across critical measures. In these approaches, it is not assumed that the same associations between measures would apply to all individuals (as when using variable-oriented methods). Via

identification of similarities across individuals (latent subgroups) in the measures of interest, we can reveal differential associations between measures that would be muddled in approaches relying on across-sample means and correlations.

Only a few studies have applied person-oriented approaches to investigate motivation, well-being, and achievement among adolescents. Roeser et al. (1998) and Roeser, Eccles, and Freeman-Doan (1999) studied patterns of adaptation among early adolescents ($N = 1,041$; $N = 491$) based on school motivation (self-perception of academic competence and academic values) and emotional functioning (depression and anger), and then linked the patterns to academic outcomes. Their analyses identified four subgroups: two groups with either positive or negative school motivation and emotional functioning; and two groups with a mismatch in levels of school motivation and emotional functioning. These findings suggested that some adolescents have low school motivation without emotional distress or academic problems, and another small subgroup may only have problems with emotional functioning. Importantly, the authors found that an association between low school motivation, poor emotional functioning, and low academic achievement was documented only for the multiple risk group and not for all adolescents. The measure of academic achievement used by Roeser et al. (1998) was based on parental and self-reports of student academic achievement and grade point average (GPA) and not on tests of specific academic skills, such as reading and math. Furthermore, the authors did not analyze the effects of low academic performance in these subjects in their design.

In a study among high school students, Tuominen-Soini and Salmela-Aro (2014) identified four profiles based on students' schoolwork engagement and burnout: two groups with positive school engagement (one with high levels of burnout) and two groups of less engaged students (also one with high levels of burnout). The analyses indicated that academic skills were lowest among the two subgroups of less engaged students. The limitation of the study was that academic skills were assessed using only the GPA. In addition, the sample was restricted to a specific educational track, upper-secondary schooling (i.e., senior high school; Tuominen-Soini & Salmela-Aro, 2014).

Unlike the above studies, Korhonen et al. (2014) identified subgroups at the end of Grade 9 (age 15–16) based on students' scores on mathematical and reading skills tests and self-reported academic well-being (school burnout, academic self-concept, and self-perceived learning difficulties). Of the four groups identified, two showed no problems, one group was characterized by low academic skills and low academic well-being, and one had low well-being despite average academic skills. The finding by Korhonen et al. (2014) indicating that academic skills and well-being are not always concordant is important. However, the narrow range of academic well-being measures, and especially the lack of measures on student motivation, leaves open the nature of associations within more comprehensive profiles of motivation, well-being, and achievement.

Overall, the literature indicates that a sizable proportion of adolescents report problems in school motivation and well-being (Korhonen et al., 2014; Roeser et al., 1998, 1999; Tuominen-Soini & Salmela-Aro, 2014), and more importantly, adolescents seem to represent a highly heterogeneous group in terms of motivation and well-being profiles at the transition to upper secondary education. Thus, it is necessary to take this variability into account when seeking an understanding of the mechanisms that drive the associations between academic skills and learning performance and measures of motivation and well-being.

1.4. The present study

In the present study, we address the limitations of previous research by employing a more comprehensive set of measures of school motivation and emotional well-being in addition to standardized tests of core academic skills in a representative sample of adolescents before the transition to separate educational tracks. We also investigate the subsequently identified profile groups with respect to information on the students' difficulties in reading and/or math performance. In this paper, standardized tests are used with the cut-off score of the 25th percentile to measure low performance in math (LM), reading (LR), or both (LM+LR) (Mazzocco, 2008; Murphy, Mazzocco, Hanich, & Early, 2007). Finally, we examine gender differences. The previous profiling studies (Korhonen et al., 2014; Roeser et al., 1998, 1999; Tuominen-Soini & Salmela-Aro, 2014) suggested

that girls tend to have a higher likelihood of belonging to subgroups that attach high value to school but also exhibit more exhaustion and internalizing behavior, whereas boys have been overrepresented in groups that show detachment from school.

We will utilize a person-oriented approach to identify profile groups of school motivation and emotional well-being. We examine their association with adolescents' reading and math skills as well as if the profile groups differ in their prevalence of low performance in math, reading, or both (LM, LR, or LM+LR). Our first hypothesis is that we will identify distinct profile groups where both school motivation and emotional well-being are at same level (high or low) and some mixed profiles, as found in previous profiling studies (Korhonen et al., 2014; Roeser et al., 1998, 1999; Tuominen-Soini & Salmela-Aro, 2014). Our second hypothesis is that there are differences between the identified profile groups in terms of academic skills (Roeser et al., 1998; 1999; Tuominen-Soini & Salmela-Aro, 2014). We expect that adolescents with low levels of school motivation and emotional well-being also have poorer skills in reading and math. We further expect that adolescents with comorbid difficulties in both reading and math will have particularly poor motivation and emotional well-being because they have poor skills in two central academic domains, making their struggle in school more widespread. Our third hypothesis is that there are gender differences in the profile groups with girls having more internalizing behavior, whereas boys have lower levels of school motivation (Korhonen et al., 2014; Roeser et al., 1998, 1999; Tuominen-Soini & Salmela-Aro, 2014).

2. Method

2.1. Participants

The participants comprised 1,629 Finnish-speaking ninth graders (age 15–16) in 95 classrooms, 52% of whom were boys. Participants were recruited as part of the Jyväskylä Longitudinal Study of Dyslexia (JLD) that has followed about 200 children since birth (Lyytinen, Erskine, Hämäläinen, Torppa, & Ronimus, 2015). The participants in this study are the JLD follow-up children and their classmates. The data of the present study was collected at a critical

developmental transition point when adolescents complete their nine-year compulsory education (after the three-year lower secondary school). At this point, students choose to either continue their studies in upper secondary school or vocational school or enter the workforce. The data was collected in classroom situations from schools located in central Finland in urban and suburban areas. All classrooms were typical Finnish lower secondary school classrooms that organize teaching according to the national curriculum and use Finnish as the language of instruction. Parents had given their written consent for their child's participation in the study.

2.2. Measures

2.2.1. School motivation

Student self-report scales were used to assess four different aspects of school motivation: math motivation, literacy motivation, task-focused behavior, and school enjoyment. Measures of math motivation and literacy motivation (i.e., motivation for native language and literature) were constructed by calculating mean scores of items assessing different types of task value. Task value was assessed by asking students 12 questions regarding math and literacy (Eccles et al., 1983). The students were asked to rate (1) how interesting, (2) how important, and (3) how useful they thought math and literacy were as school subjects using a 5-point scale (*1 = not at all, 5 = very much*). Two items asked about the three dimensions of task value (interest, importance, and utility) separately for math and literacy. Cronbach's alpha reliability coefficients were .90 for math (six items) and .88 for literacy (six items).

To assess students' task-focused behavior, we used a shortened version of the original 20-item Achievement Beliefs Scale for Children (ABS-C; Aunola & Nurmi, 2006). The present analysis utilized seven item statements that assessed students' typical task-focused behavior in academic situations when facing a difficult task (e.g., *reversed, I also like difficult school tasks*). A composite score was created by computing the mean of these seven items by first reversing the scaling of the five negatively worded items (e.g., *I give up if the task in school feels difficult*). Cronbach's alpha reliability coefficient for the scale was .81.

For assessing school enjoyment, we used four items from the ABS-C (Aunola & Nurmi, 2006) that examine students' typical attitudes and feelings toward school and schoolwork (e.g., *It is nice to come to school*). A composite score was created by computing the mean of the four items (one negatively worded item was reversed). Cronbach's alpha reliability coefficient for the scale was .75.

2.2.2. Low emotional well-being

Low emotional well-being was assessed with four measures capturing school burnout, low self-esteem, externalizing behavior, and internalizing behavior. School burnout was assessed by using the School Burnout Inventory (SBI; Salmela-Aro & Näätänen, 2005; for validity and reliability, see Kiuru, Aunola, Nurmi, Leskinen, & Salmela-Aro, 2008). The SBI consists of 10 items and three subscales: exhaustion at school (four items; e.g., *I feel overwhelmed by my schoolwork*); cynicism toward the meaning of school (three items; e.g., *I feel that I am losing interest in my schoolwork*); and a sense of inadequacy as a student (three items; e.g., *I often have feelings of inadequacy in my schoolwork*). Participants in the study rated the items using a 5-point scale (*1 = totally agree, 5 = totally disagree*). However, to calculate the composite score, the answers were converted to represent the original 6-point scale of the test manual. Subscale means were calculated for exhaustion, cynicism, and inadequacy according to the manual, and a total burnout score was calculated by averaging the three subscale scores. Cronbach's alpha reliability for the total burnout scale was .74.

Low self-esteem was assessed using a five-item shortened version of the Rosenberg (1965) Self-Esteem scale, which captures the aspects of self-respect, general acceptance of self, and overall conception of the self (e.g., *I believe I have many good qualities*). Ratings were given on a 5-point scale (*1 = not true, 5 = very much true*). A composite score of low self-esteem was created by computing a mean of the five items (three positively worded items were reversed). Cronbach's alpha reliability for self-esteem issues was .80.

Students' externalizing and internalizing behavior problems were assessed using items that the students self-rated. Externalizing behavior was assessed with four items that reflect aggressive behavior and conduct problems: *Other children annoy me, I often get mad and lose my temper, I fight or argue a lot, and I get irritated easily*. Internalizing behavior was assessed with five items reflecting anxiety and depression: *I am worried about many things, I often feel like crying, I get tired easily, I often have a stomachache or headache, and I am often unhappy or down*. Cronbach's alphas were .83 and .81 for externalizing behavior problems and internalizing behavior problems, respectively.

2.2.3. Academic skills in reading and math

Reading fluency was assessed with the following three group-administered tasks: sentence reading, error search, and word chains task. Students were instructed to do all tasks as accurately and as quickly as possible. In the sentence reading task, the participants were asked to read and verify the truthfulness (true or false) of as many sentences as possible within two minutes (Mayringer & Wimmer, 2003). The sentences were short and easy and required a minimal amount of comprehension or specialized knowledge (e.g., *A ball is round; Blueberries are yellow*). In the error search task, the students were asked to silently read words written on a sheet of paper and mark as many incorrectly spelled words (either a wrong letter, extra letter, or missing letter) as possible in three minutes (Holopainen, Kairaluoma, Nevala, Ahonen, & Aro, 2004). In the word chains task, the students were presented with chains of words written together without spaces between consecutive words. The students were asked to identify and mark on the sheet as many word boundaries as possible in 90 seconds (Holopainen et al., 2004). Each of the three measures represented a sum score calculated by subtracting the number of incorrect answers from the number of correct answers or correctly identified words in the word chains task. The measure for reading fluency was the mean of the standardized scores of the three group-administered tasks. Cronbach's alpha reliability coefficient for the reading fluency composite score was .78.

Reading comprehension was assessed using the Program for International Student Assessment (PISA) reading items for Grade 9 students' reading achievement. The items have been used repeatedly in each cycle of the PISA reading assessments to ensure the comparability of the measurement (Organisation for Economic Cooperation and Development [OECD], 2010, p. 26; 2013, p. 45). The booklet presented to the students included eight texts or other materials, such as tables, graphs, and figures, and 15 multiple-choice questions and 16 open-ended questions. Of the questions, 12 required students to access and retrieve information, 12 to integrate and interpret information, and 7 to reflect and evaluate information. After the instructions were given, the students had 60 minutes to complete the task. The sum score for reading comprehension was calculated by summing the item scores derived by using the detailed PISA scoring instructions. Cronbach's alpha reliability coefficient for the total score was .80.

Mathematical skills were assessed using the standardized arithmetic test for grade level (Räsänen & Leino, 2005). The scale is intended for Grades 7 through 9 (13–16 years). The test contains 40 items, producing a maximum of 40 points. This scale assesses students' performance in basic arithmetic tasks (addition, subtraction, multiplication, and division), as well as in word problem solving, algebra, geometry, and unit conversion skills. This screening test is used in Finland to identify students at risk for mathematics difficulties. Cronbach's alpha reliability coefficient for the sum score was .90.

2.2.4. Low math and reading performance

Math performance was assessed using math assessments and reading performance was assessed using reading comprehension (PISA) assessments. The 25th percentile was used as a cut-off score for identifying students with low math performance, low reading performance, or both. We chose to use this cut-off score since it is commonly used to distinguish students with and without learning difficulties and thus facilitates comparisons to other studies (e.g. Mazzocco, 2008; Murphy et al., 2007).

2.3. Procedure

Assessments were carried out in the students' classrooms during the school day by trained testers (university researchers or final-phase psychology graduate students) between January and April 2010 in Grade 9. The data consisted of academic test scores and student self-reports using questionnaires for school motivation and emotional well-being. All the data was collected from the students in each classroom on the same day they were assessed. The research was conducted following the Declaration of Helsinki and the project has received ethical consent from the ethical board of the University of Jyväskylä.

2.4. Data analyses

Latent profile analysis (LPA) was used to identify subgroups with similar well-being (four measures) and motivation (four measures) profiles. The identified subgroups were compared in terms of their reading and math performance status as well as continuous reading and math skill variables. LPA is a model-based variant of the traditional cluster analysis (Vermunt & Magidson, 2002) where the goal is to identify the smallest number of latent groups based on associations among the observed continuous variables. The number of latent groups was decided using the Bayesian information criterion (BIC), Akaike information criterion (AIC), Vuong-Lo-Mendell-Rubin (VLMR) test, and adjusted Lo-Mendell-Rubin (LMR) likelihood ratio tests as well as theoretical consideration. Also considered were the classification quality, the entropy value, and the usefulness and interpretability of the latent classes. Next, one-way analyses of variance (ANOVAs) were conducted to validate the emergent profiles by comparing them in terms of the criterion variables. Mplus 6.1 was used to conduct LPA (Muthén & Muthén, 1998–2010). Multivariate analyses of variance (MANOVAs), ANOVAs, and cross-tabulations were run in PASW 18.

3. Results

3.1. Descriptive statistics

Descriptive statistics for school motivation, emotional well-being, and academic skills are presented in Table 1. All variables were approximately normally distributed. Some statistically

significant gender differences were detected in the school motivation measures. Girls' motivation for literacy was higher than that of boys ($t(1627) = 15.01, p < .001$), and on average, girls enjoyed school more than boys ($t(1627) = 7.99, p < .001$). However, girls were found to have lower self-esteem ($t(1627) = 11.82, p < .001$), and they reported more externalizing behavior ($t(1627) = 5.81, p < .001$) and more internalizing behavior ($t(1627) = 17.08, p < .001$) than boys.

Table 1*Descriptive statistics*

	All						N	Boys		Girls	
	N	M (SD)	Min	Max	Skewness (SE)	Kurtosis (SE)		M (SD)	N	M (SD)	
Math motivation	1629	3.17 (0.88)	1	5	-0.13 (0.06)	-0.52 (0.12)	783	3.19 (0.88)	846	3.14 (0.88)	
Literacy motivation	1629	3.21 (0.81)	1	5	-0.13 (0.06)	-0.21 (0.12)	783	2.92 (0.74)	846	3.48 (0.78)	
Task-focused behavior	1628	2.90 (0.72)	1	5	-0.04 (0.06)	-0.09 (0.12)	782	2.92 (0.71)	846	2.89 (0.72)	
School enjoyment	1628	3.04 (0.82)	1	5	-0.30 (0.06)	-0.28 (0.12)	782	2.87 (0.82)	846	3.19 (0.80)	
School burnout	1607	29.95 (9.69)	9	60	0.42 (0.06)	0.10 (0.12)	767	29.58 (9.54)	840	30.28 (9.82)	
Low self-esteem	1614	2.59 (0.76)	1	5	0.08 (0.06)	-0.06 (0.12)	774	2.37 (0.71)	840	2.80 (0.76)	
Externalizing behavior	1603	2.31 (0.85)	1	5	0.45 (0.06)	-0.05 (0.12)	765	2.18 (0.82)	838	2.43 (0.86)	
Internalizing behavior	1604	2.41 (0.87)	1	5	0.46 (0.06)	-0.25 (0.12)	765	2.05 (0.74)	839	2.73 (0.86)	
Math	1435	23.31 (7.08)	0	45	-0.24 (0.06)	-0.19 (0.13)	693	24.41 (7.23)	742	22.23 (6.78)	
Reading fluency	1608	0.01 (0.87)	-4.58	2.66	-0.18 (0.06)	0.46 (0.12)	771	-0.27 (0.86)	837	0.26 (0.80)	
Reading comprehension	1040	22.98 (6.11)	2.33	33.7 3	-0.74 (0.08)	0.09 (0.15)	500	21.67 (6.53)	540	24.20 (5.42)	

3.2. Latent profile analysis (LPA)

To identify profile groups for school motivation and well-being, LPA was conducted. A solution with seven groups was selected based on the indices provided by Mplus (see Table 2). The seven-group solution represented a good fit with the data. The AIC and BIC values suggested that a solution with even more groups could be applicable (the values continued to decrease even for eight groups). However, based on the VLMR and LMR tests, the seven-group solution was most preferable. On closer examination, it was found that three of the seven groups were very close to the average level in all motivation and well-being measures (less than half a standard deviation from the overall average for all). Thus, for subsequent analyses, we decided to merge these three average groups for a final subgroup solution of five groups.

The following three of the five profile groups showed a concordant pattern across the measures (Figure 1): a group with high motivation and high well-being (HM/HW; $n = 178$, 52% girls); a group with an average profile (i.e., average motivation and average well-being; AM/AW; $n = 1107$, 52% girls); and a group with low motivation and low well-being (LM/LW; $n = 121$, 67% girls). Two profile groups showed mixed motivation and well-being: one group had low motivation and average well-being (i.e., low motivation; LM; $n = 140$, 17% girls), and the other group had average motivation despite low well-being (i.e., low well-being; LW; $n = 83$, 87% girls). The groups were found to be distinct (see Table 3) with respect to the measures of school motivation and emotional well-being included in the LPA, which validates the existence of the groups.

Gender was found to be unevenly distributed in the profile groups ($\chi^2(4, 1629) = 119.11$, $p < .000$). The observed proportion of boys was statistically higher than expected (adjusted standardized residual = 8.62) in the LM group, and the observed proportion of girls was higher than expected (adjusted standardized residual = 3.43) in the LM/LW group and in the LW group (adjusted standardized residual = 6.52).

Table 2*Latent profile analysis*

Number of classes	log L	BIC	AIC	Entropy	VLMR	LMR	<i>n</i> (class 1)	<i>n</i> (class 2)	<i>n</i> (class 3)	<i>n</i> (class 4)	<i>n</i> (class 5)	<i>n</i> (class 6)	<i>n</i> (class 7)	<i>n</i> (class 8)
1	-18363.193	36844.717	36844.717	–	–	–	1629							
2	-17337.888	34860.670	34725.777	.75	0	0	727	902						
3	-16998.461	34248.377	34064.923	.75	0	0	738	386	505					
4	-16630.636	33579.289	33347.273	.77	0	0	510	501	407	211				
5	-16526.182	33436.942	33156.364	.75	0.07	0.07	252	189	421	244	523			
6	-16409.810	33270.758	32941.619	.75	0.04	0.04	178	477	263	199	407	105		
7	-16293.777	33105.255	32727.555	.77	0.02	0.02	140	121	287	413	178	407	83	
8	-16232.853	33049.967	32623.705	.78	0.32	0.33	162	159	48	404	79	419	80	278

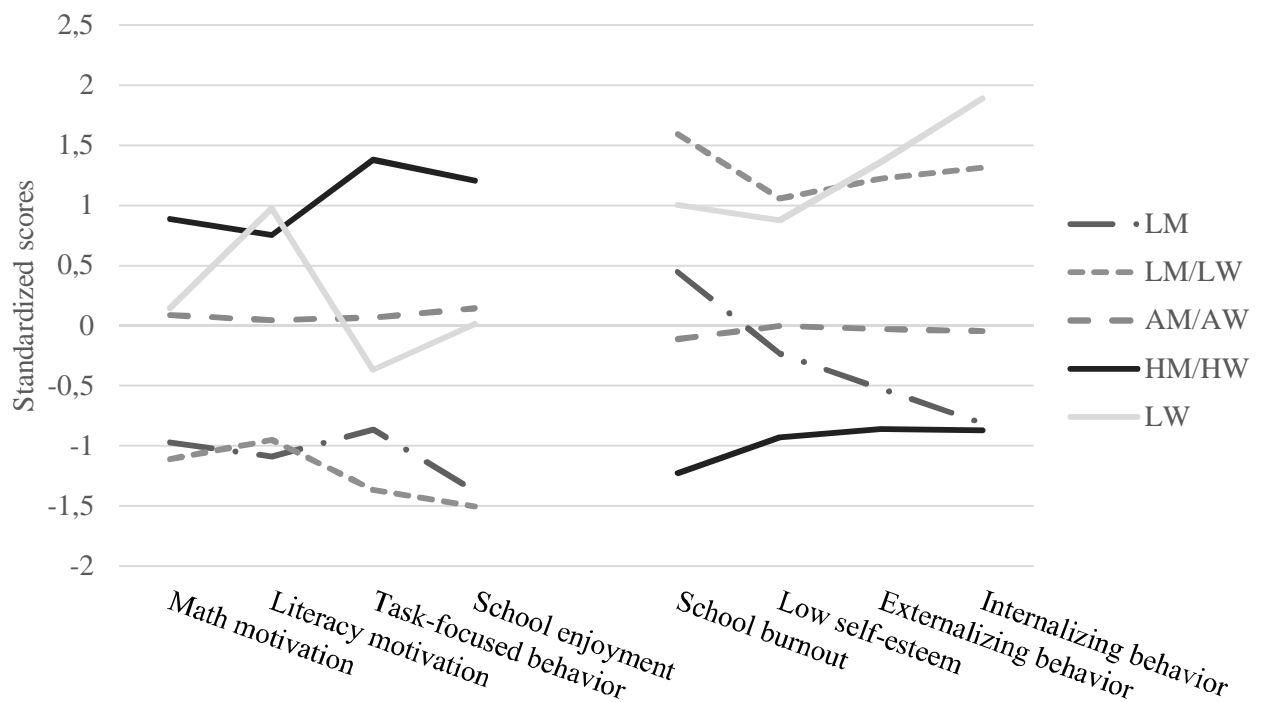


Figure 1. Students' standardized mean scores on the school motivation and emotional well-being scales as a function of group membership.

Table 3

Profile groups' school motivation and emotional well-being measures

Grade 9	HM/HW		AM/AW		LM/LW		LM		LW		ANOVA
	N	M (SD)	N	M (SD)	N	M (SD)	N	M (SD)	N	M (SD)	
Math motivation	178	3.95 ^c (0.66)	1107	3.25 ^b (0.77)	121	2.19 ^a (0.74)	140	2.31 ^a (0.71)	83	3.29 ^b (0.85)	$F(4, 1624) = 146.54^{***}$
Literacy motivation	178	3.83 ^d (0.63)	1107	3.25 ^c (0.70)	121	2.44 ^a (0.73)	140	2.33 ^a (0.65)	83	4.01 ^d (0.64)	$F(4, 1624) = 114.93^{***}$
Task-focused behavior	178	3.90 ^d (0.46)	1106	2.95 ^c (0.55)	121	1.92 ^b (0.54)	140	2.29 ^a (0.66)	83	2.64 ^e (0.53)	$F(4, 1623) = 259.06^{***}$
School enjoyment	178	4.03 ^c (0.48)	1106	3.16 ^b (0.61)	121	1.80 ^a (0.53)	140	1.91 ^a (0.53)	83	3.05 ^b (0.54)	$F(4, 1623) = 413.52^{***}$
School burnout	176	18.07 ^d (4.86)	1088	28.87 ^c (7.51)	120	45.38 ^b (7.89)	140	34.26 ^a (6.55)	83	39.66 ^e (9.11)	$F(4, 1602) = 304.43^{***}$
Low self-esteem	177	1.88 ^d (0.59)	1096	2.59 ^c (0.66)	120	3.40 ^b (0.74)	140	2.41 ^a (0.73)	81	3.26 ^b (0.80)	$F(4, 1609) = 114.47^{***}$

Externalizing behavior	176	1.58 ^c (0.55)	1085	2.28 ^a (0.73)	120	3.35 ^b (0.69)	140	1.87 ^a (0.66)	82	3.46 ^b (0.76)	$F(4, 1598) = 181.85^{***}$
Internalizing behavior	176	1.64 ^a (0.45)	1085	2.37 ^c (0.70)	120	3.55 ^b (0.67)	140	1.70 ^a (0.46)	83	4.06 ^d (0.50)	$F(4, 1599) = 334.96^{***}$

Note. The pairs with the same subscript letters do not significantly differ statistically ($p > .05$) based on the ANOVA post hoc (Bonferroni corrected) paired comparisons.

3.3. Differences in academic skills between profile groups

The second aim of the study was to compare the identified profile groups in math, reading fluency, and reading comprehension. One-way ANOVAs revealed statistically significant differences between the profile groups in math ($F(4, 22.07) = 23.45, p < .00$), reading fluency ($F(4, 6.50) = 8.79, p < .00$), and reading comprehension ($F(4, 19.76) = 21.51, p < .00$; see Table 4). The two profile groups with low school motivation (LM and LM/LW) had lower scores in math and reading comprehension than the other profile groups. Students in the LM group also had lower scores in reading fluency than the other profile groups. However, students who had at least average school motivation (HM/HW, AM/AW, and LW) scored higher on all academic skills tests than the profile groups with low school motivation. The subgroup with no problems in school motivation or emotional well-being (HM/HW) scored the highest on the math skills and reading comprehension tests; however, the subgroup with average school motivation and low emotional well-being (LW) scored highest on the reading fluency subtest.

Table 4

Profile groups' math and reading performance

	HM/HW		AM/AW		LM/LW		LM		LW		ANOVA
	<i>N</i>	<i>M (SD)</i>	<i>N</i>	<i>M (SD)</i>	<i>N</i>	<i>M (SD)</i>	<i>N</i>	<i>M (SD)</i>	<i>N</i>	<i>M (SD)</i>	
Reading fluency	177	0.14 ^{bc} (0.84)	1095	0.01 ^{bc} (0.86)	116	0.01 ^b (0.85)	137	-0.34 ^a (0.87)	83	0.29 ^b (0.83)	$F(4, 1608) = 8.79^{***}$
Reading comprehension	138	25.42 ^{bc} (5.51)	863	23.16 ^b (6.01)	95	20.31 ^a (5.46)	108	19.66 ^a (6.42)	63	23.99 ^{bc} (5.87)	$F(4, 1267) = 21.51^{***}$

Math	164	25.59 ^c (6.55)	984	23.50 ^b (6.92)	97	19.39 ^a (6.43)	117	20.21 ^a (7.39)	73	23.51 ^b (6.56)	$F(4, 1435) = 23.45^{***}$
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Note. The pairs with the same subscript letters do not significantly differ statistically ($p > .05$) based on the ANOVA post hoc (Bonferroni corrected) paired comparison.

3.4. Profile groups and math and reading performance

Finally, profile group differences were examined with respect to the proportion of adolescents with low performance in math, reading, or both. Cross-tabulation of the low performance status and the profile group (see Table 5) indicated that students with low performance in math were more likely than expected to belong to the LM/LW subgroup (adjusted standardized residual = 5.55). Low performance in reading and co-morbid low performance in math and reading were only associated with low school motivation; students with low performance in math and reading were more likely than expected to belong to the LM subgroup (adjusted standardized residual = 4.20). Finally, the students with no difficulties in math or reading (based on the 25th percentile criterion) were more likely than expected to belong to the HM/HW subgroup (adjusted standardized residual = 3.19) and were more unlikely than expected to belong to the LM/LW subgroup (adjusted standardized residual = -5.97).

Table 5

Cross-tabulation of math and reading performance groups by profile subgroups

	HM/HW n (%) Adjusted residuals	AM/AW n (%) Adjusted residuals	LM/LW n (%) Adjusted residuals	LM n (%) Adjusted residuals	LW n (%) Adjusted residuals	Total
Low math performanc e	7 (5.43%) -1.85	72 (9.34%) -1.15	22 (28.21%) 5.54	10 (10.87%) 0.28	2 (3.57%) -1.65	113 (10.04%)
Low reading performanc e	8 (6.20%) -1.14	67 (8.69%) -0.33	10 (12.82%) 1.27	13 (14.13%) 1.85	2 (3.57%) -1.43	100 (8.88%)
Low math and reading	4 (3.10%) -2.00	48 (6.23%) -2.32	11 (14.10%) 2.31	17 (18.48%) 4.20	4 (7.14%) -0.90	84 (7.46%)

performance						
No difficulties	110 (85.27%)	584 (75.75%)	35 (44.87%)	52 (56.52%)	48 (85.71%)	829 (73.62%)
	3.19	2.38	-5.97	-3.88	2.11	
Total	129 (100%)	771 (100%)	78 (100%)	92 (100%)	56 (100%)	1126

4. Discussion

The present study contributes to the literature by examining profiles of Grade 9 students' school motivation and emotional well-being using a person-oriented approach. This research also applied a more comprehensive measurement battery than previous studies. In addition, instead of using the GPA or school grades, the present study assessed students' math and reading skills at an important time point, the end of lower secondary school just before the transition to upper secondary education. The findings suggested that a substantial proportion (21%) of students had either low motivation or low emotional well-being or both. Of specific interest was the emergence of mixed groups, which implies that the level of motivation and well-being do not always go together. For example, some students with high motivation may experience school burnout, internalizing problems, externalizing problems, and low self-esteem. Furthermore, the findings indicated that math and reading performance could be low in any of the profile groups. However, students with low motivation were more likely to show low levels of math and reading or math performance.

In accordance with our first hypothesis, distinguishable profiles were identified. Three of the five profile groups had concordant motivation and emotional well-being levels, either high, average, or low. Students in the first profile group with high motivation and well-being (HM/HW; 11%) enjoyed school, were highly task-focused, showed motivation for math and literacy, and had no signs of low emotional well-being. The students with average motivation and well-being

(AM/AW; 68%) constituted the largest subgroup. These students showed an average level of subject specific interest, liked to attend school, and had no signs of low emotional well-being. The third profile group manifested low motivation and well-being (LM/LW; 7%).

The final two groups had mixed profiles. The first mixed group showed low school motivation despite average well-being (LM; 9%). This group showed positive overall well-being except for heightened school burnout. These students, which consisted of mostly boys, reported low interest in math and literacy, low focus on school tasks, and low school enjoyment. The second mixed group, comprising mostly girls, showed low emotional well-being despite average school motivation (LW; 5%). This group had, in particular, a tendency to internalize problems but had no problems with school motivation, and their literacy motivation was particularly high. Our finding on mixed groups (LM and LW) concurs with previous suggestions that low school motivation does not always imply a broader pattern of poor well-being (see also Roeser et al., 1998, 1999; Tuominen-Soini & Salmela-Aro, 2014), as it is possible that these students take a keen interest in activities outside school rather than schoolwork (Roeser et al., 1998).

A potentially worrying profile is shown by the low school motivation and well-being subgroup, which constituted 10% of the sample. Similar subgroups have been identified in previous studies, although constituting somewhat higher proportions, ranging from 14% (Tuominen-Soini & Salmela-Aro, 2014, based on school engagement and burnout) to 18% (Korhonen et al., 2014, based on academic achievement and well-being) and up to 30% (Roeser et al., 1998, based on school motivation and emotional functioning). These students can be considered at risk for restricted educational and economic attainment (Roeser et al., 1998), school drop-out, and other negative consequences later in life (Korhonen et al., 2014; Roeser et al., 1998, 1999).

After identifying the profile groups, we analyzed their associations with academic skills (math and reading) using continuous as well as dichotomous measures. The dichotomous approach was motivated by the interest to see if students with single versus co-occurring low skills in math and reading had different profiles in motivation and emotional well-being. According to the second

hypothesis, a comparison of the profile groups indicated differences in their math and reading performance. The two groups with low school motivation (LM & LM/LW) had lower math and reading scores than the other groups. Furthermore, in these profile groups, the frequency of poorly performing (lowest 25%) adolescents in math and reading was higher than expected. Interestingly, low motivation in particular was linked to low math and reading performance, whereas low emotional well-being did not show this association. Poor academic skills have also been shown to correlate with school burnout, especially cynicism (Salmela-Aro, 2009), low school value (Wigfield & Cambria, 2010), and low school attachment (Roeser et al., 1998, 1999). The causal mechanisms are likely to be reciprocal in that poor academic skills can be one reason for low school motivation, but poor motivation can also have an impact on skill development (Klauda & Guthrie, 2015).

Particularly, the adolescents with low skills in both math and reading were overrepresented in the two groups with low motivation (LM and LM/LW). Thus, these two groups presented comorbid math and reading problems in addition to low motivation. This finding represents a risk for poor educational attainment and engagement and, consequently, marginalization from education and work. In learning disability literature, comorbid math and reading difficulties have been shown to have a more severe underlying deficit in comparison to a single difficulty (Moll, Silke, Göbel, & Snowling, 2015; Vukovic, 2012).

As was expected, and in line with previous studies (Korhonen et al., 2014; Roeser et al., 1998, 1999), more than half of the students (55%) in the low motivation and well-being subgroup (LM/LW) also displayed low performance in math and reading comprehension. A novel finding of the present study is that while these students had a higher incidence of math problems and/or reading comprehension problems, their reading fluency was at the average level. This suggests a difficulty with comprehension rather than the typical dyslexia profile characterized by deficient fluency. The math and reading comprehension tests used in this study demanded a longer period of concentration than the speeded reading fluency task; thus, the ability to focus on the task was required more than for the fluency task performance. Also task-focused behavior was the lowest

among students in this group. Not all struggling learners have an inherent risk for low performance, but they may experience a lack of high-quality instruction at school (Vukovic, 2012). However, an understanding of the causal mechanisms is also lacking. It has been suggested that learning and motivational difficulties develop reciprocally and accumulate over time (Roeser et al., 1999). Thus, resources should be allocated at the first sign of problems. In addition, the intervention efforts should take a comprehensive approach, including support for motivation, emotional well-being, and academic skills.

The mixed profile subgroup with low well-being but average motivation (LW) had no problems in math or reading. In fact, these students' reading fluency was the highest of all the subgroups, and the incidence of low performance in math and/or reading (below 25%) was very small. Although these students' school motivation and academic skills were at a high level, they reported high levels of burnout at school. Similarly to earlier studies (see also Roeser et al., 1998; Tuominen-Soini & Salmela-Aro, 2014), this finding suggests that for this subgroup of predominantly girls, high academic goals and a strong commitment to school may make them vulnerable to exhaustion and low well-being. However, because their academic achievement is high, these students' problems may go unnoticed at school, as also suggested in Roeser et al. (1999); therefore, screening of well-being at school is important.

The identification of groups with concordant profiles (corresponding levels of motivation and well-being) and groups with mixed profiles (low in one and high or average on the other domain) was in accordance with previous studies that examined adolescent profiles based on school motivation (academic competence beliefs and academic values) and emotional functioning (depression and anger; Roeser et al., 1998, 1999), school engagement (energy, dedication, and absorption) and burnout (Tuominen-Soini & Salmela-Aro, 2014), as well as academic performance (math, spelling, and reading) and academic well-being (academic self-concept, perceived LDs, and school burnout; Korhonen et al., 2014). A similar phenomenon of mixed profiles has also been

documented in mental health research, referred to as a dual-factor, two-continua, or bi-dimensional model (e.g., Renshaw, Eklund, Bolognino & Adodo, 2016; Suldo & Schaffer, 2008).

In line with the third hypothesis and previous studies girls had more internalizing behavior, and boys had lower levels of school motivation (Roeser et al., 1998, 1999; Tuominen-Soini & Salmela-Aro, 2014), but not in all measures, only lower levels of school enjoyment and literacy motivation. Furthermore, other studies have shown additional reasons to worry over boys. Males have for example been shown to be overrepresented among young people who are neither in employment nor in education or training in Finland (Organisation for Economic Cooperation and Development [OECD], 2016).

Overall, the present findings supported previous studies in that task-focused behavior (Dweck et al., 1995; Elliot et al., 1999; Onatsu-Arvilommi & Nurmi, 2002), school enjoyment (Hagenauer & Hascher, 2014; Pekrun, 1992, 2006, 2009), and math and literacy motivation (Eccles et al., 1983; Wigfield & Cambria, 2010; Wigfield & Eccles, 1992, 2000) were associated with school achievement. The novel finding was that reading fluency, reading comprehension, math performance, and their comorbid difficulties had different links to school motivation and emotional well-being profiles. Whereas the relationship between school motivation and math and reading performance was clear, the link between emotional well-being and school achievement was more indirect. Although we found groups with low school motivation to have a higher percentage of students with low performance in math and/or reading, low performance did not always indicate problems in the other domains. For example, the group with average motivation and well-being also included many adolescents with low performance in math and/or reading.

The findings suggest heterogeneity within adolescents with low academic performance. Therefore, it is important to note that not all students may benefit from similar educational support, and a more comprehensive approach is needed to be able to support motivation, well-being, and learning. The findings also contribute practical knowledge for teachers and aids with intervention planning. Students with low motivation and low well-being are those at the highest risk for negative

consequences in life. However, high levels of school motivation and school achievement do not guarantee emotional well-being. Therefore, school personnel should be interested in students beyond their achievement level or even beyond school motivation, and pay attention to subtle signs of students' well-being, which may at first go unnoticed.

This study has several limitations that need to be taken into account when interpreting the results. First, this study was conducted in Finland where the school system and the services provided may differ from other countries; therefore, generalizing the findings to very different educational systems should be done carefully (Björn, Aro, Koponen, Fuchs, & Fuchs, 2016). Second, we used the 25% cutoff to determine low performance, which, although used commonly, is quite lenient (e.g. Murphy et al., 2007). Third, the study was cross-sectional, which precludes addressing causal links between skills, motivation, and well-being. Fourth, environmental factors, such as the quality of special education in the school, support from the teacher, family, and friends, and free time activities that may play a role in the associations, were not controlled for in this design.

The present study contributes to the existing literature by showing that a substantial number of adolescent have either low motivation, low emotional well-being, or both at the end of comprehensive school. Furthermore, students with diverse school motivation and emotional well-being profiles show different associations with math and reading performance. However, low emotional well-being was associated with academic performance only if a student also had low school motivation.

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