

Gendered pathways from academic performance, motivational beliefs, and school burnout to adolescents' educational and occupational aspirations

Anna Widlund^{a,*}, Heta Tuominen^{b,c}, Anna Tapola^b, Johan Korhonen^a

^a Faculty of Education and Welfare Studies, Åbo Akademi University, P.O. Box 311, 65101, Åbo Akademi University, Vasa, Finland

^b Faculty of Educational Sciences, University of Helsinki, P.O. Box 9, 00014, University of Helsinki, Helsinki, Finland

^c Turku Institute for Advanced Studies & Department of Teacher Education, University of Turku, 20014, University of Turku, Turku, Finland

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ABSTRACT

This study examined Finnish 9th-graders' ($N = 966$) pathways to educational and occupational aspirations considering two academic domains: mathematics and reading. Multi-group structural equation models were conducted to investigate how domain-specific performance and motivational beliefs (self-concept and interest), and more general school burnout (exhaustion, cynicism, and inadequacy) relate to boys' and girls' aspirations. Performance in both domains was related to girls' educational aspirations, but only mathematics was linked to boys' aspirations. Positive within-domain relations from girls' motivational beliefs were also found, but their reading self-concept was negatively linked to their math-related occupational aspirations. For boys, only math-related motivational beliefs were associated with their aspirations. Lastly, school burnout was both directly and indirectly linked to students' aspirations. Overall, the study demonstrated the importance of including several factors when investigating students' aspired educational degrees and occupational plans and, also, the added value of examining educational and occupational aspirations across academic domains.

1. Introduction

Students' decision-making processes about their future are important considering that aspirations have been found to be one of the main predictors of actual educational and occupational attainment (Armstrong & Crombie, 2000; Schoon & Parsons, 2002). According to prominent theories of motivation (e.g., expectancy-value theory; Eccles et al., 1983), the processes leading to such aspirations are shaped by students' expectancies of success (e.g., self-concept) and by value-laden motivational beliefs (e.g., interest), but also several academic factors (e.g., performance) have been identified as important predictors (e.g., Guo, Marsh, Parker, Morin, & Dicke, 2017). However, there seem to be gender differences in both the level and field of aspired education and occupation; girls persistently show less interest in math-related careers, and are more interested in fields related to literature and reading, whereas the opposite applies for boys (Eccles, 2009; Lazarides & Lauermann, 2019). Similar gender differences have been found in the pathways leading to students' aspirations as well (Korhonen, Tapola, Linnanmäki, & Aunio, 2016), and could possibly reflect the rationale behind the Internal/External frame of reference model (I/E model) and gender-typical comparison processes (Marsh, 1986; Marsh et al., 2015),

that is, that boys identify more strongly with mathematics and, consequently, put more emphasis on it, whereas a similar pattern applies for girls in reading. According to the I/E model, high performance in one domain might result in lower self-concept in another domain. However, although the I/E model has been useful for predicting motivational beliefs, it has rarely been applied to career-relevant pathways, despite its potential relevance.

Although research and theory (e.g., Marsh et al., 2015; Parker, Nagy, Trautwein, & Lüdtke, 2014) suggest that focusing solely on a single domain provides a limited perspective of understanding gendered pathways to students' aspirations, the majority of existing research has focused only on mathematics, mainly to explain the underrepresentation of women in many math-related fields (e.g., Watt et al., 2012). In addition, even though studies have shown that school-related well-being is linked with important educational outcomes, such as academic achievement (Schaufeli, Martinez, Pinto, Salanova, & Bakker, 2002), motivation (Tuominen-Soini, Salmela-Aro, & Niemivirta, 2012), and dropout (Bask & Salmela-Aro, 2013), it has largely been ignored when investigating students' decision-making processes concerning education and occupation. As there is also evidence of decrease in school-related well-being among adolescents and particularly girls

* Corresponding author.

E-mail addresses: anna.widlund@abo.fi (A. Widlund), heta.tuominen@helsinki.fi, heta.tuominen@utu.fi (H. Tuominen), anna.tapola@helsinki.fi (A. Tapola), johan.korhonen@abo.fi (J. Korhonen).

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(Wang, Chow, Hofkens, & Salmela-Aro, 2015), it seems important to consider factors such as exhaustion at school and negative feelings towards school (i.e., burnout), as well.

In order to gain a better understanding of persistent stereotyped gender differences in both aspirations and career attainment and of the factors underlying them, it seems necessary to learn more about how performance, competence beliefs, and values jointly shape students' educational and occupational aspirations across academic domains, and whether school burnout plays a role in shaping them. Therefore, the aim of this study was to investigate within- and between-group differences in gendered pathways to educational and occupational aspirations in the two key academic domains of mathematics and reading. The study adds to existing research by incorporating several domain-specific predictors in the study design, each of which are also considered as serving different functions in the formation of students' aspirations. Thus, we focused on students' performances in both mathematics and reading skills tests, their domain-specific motivational beliefs (i.e., self-concept and interest), and domain-general school burnout (exhaustion, cynicism, and inadequacy). Considering that gendered pathways to aspirations have rarely been investigated across academic domains, our study further contributes to the research literature by examining cross-domain relations between performance, motivational beliefs, and occupational aspirations in mathematics and reading.

1.1. Educational and occupational aspirations

Adolescents' aspirations about their future influence their choices, decisions, and activities, which, in turn, may influence subsequent attainment later in life (Mau & Bikos, 2000; Nurmi, 2004). Educational aspirations refer to students' goals and plans within an academic setting and have commonly been described as either idealistic or realistic; idealistic aspirations referring to students' desired attainment level, whereas realistic aspirations reflect students' actual perceived likelihood of completing the aspired level of education (Chow, Eccles, & Salmela-Aro, 2012; Durik, Vida, & Eccles, 2006). Occupational aspirations refer to students' plans concerning their future occupation and career. Studies have commonly focused on the level of prestige associated with the aspired occupation (e.g., social status or importance; Gottfredson, 1981) or on a specific domain or career type (e.g., Lazarides & Lauermaann, 2019).

Regarding gender differences in aspirations, findings are rather mixed; a few studies have found that boys aspire to higher educational degrees (e.g., Mendez & Crawford, 2002), but others have found them to be higher among girls (Mau & Bikos, 2000; Salmela-Aro & Upadyaya, 2017). There have also been studies demonstrating no gender differences at all (Watt et al., 2012). Similar results have been found regarding the prestige aspect of occupational aspirations: some studies have found no gender differences (Mau & Bikos, 2000), and others have shown either girls' (Mendez & Crawford, 2002) or boys' (Rojewski, 2002) occupational aspirations to be less prestigious. However, as for domain-specific occupational aspirations, boys tend to aspire more to math- and science-related careers (e.g., Parker et al., 2014; Watt et al., 2012), whereas girls seem to aspire to humanistic fields and careers that involve social interaction (Parker et al., 2014; Wigfield & Eccles, 2002).

To summarize, the degrees and choices to which students aspire to seem to vary as a function of gender (Korhonen et al., 2016; Lazarides & Lauermaann, 2019; Watt et al., 2012). In order to better understand these differences, it would be important to try to identify potential factors influencing students' aspirations.

1.2. Predictors of educational and occupational aspirations

1.2.1. Academic performance

Students' performance significantly affects both their educational (Korhonen et al., 2016) and occupational aspirations (Guo, Marsh,

Morin, Parker, & Kaur, 2015), and these effects have been found in both mathematics (e.g., Shapka, Domene, & Keating, 2006) and reading domains (Savolainen, Ahonen, Aro, Tolvanen, & Holopainen, 2008). Overall, boys tend to perform slightly better in mathematics, but there seem to be larger gender gaps in reading, favoring girls (Else-Quest, Hyde, & Linn, 2010; Marks, 2008). Although Finland is among the highest-ranking countries in both students' mathematics and reading performance, similar gender gaps exist with regard to reading (OECD, 2019). In mathematics, however, gender differences are exceptionally small, and Finnish girls have even been found to outperform boys (OECD, 2013, 2019; Reilly, 2012).

Korhonen et al. (2016) investigated the effects of mathematics and reading performance on students' educational aspirations simultaneously, and found mathematics to be more important in shaping boys' aspirations, whereas reading was more influential for girls. However, some of the effects were indirect, going through students' interest, indicating that performance alone does not fully explain students' aspirations and educational choices. In fact, motivational beliefs have been found to have a mediating role, linking academic performance and educational choices and aspirations (Eccles, 2009; Nagy, Trautwein, Baumert, Köller, & Garrett, 2006; Parker et al., 2014).

1.2.2. Motivational beliefs

Most previous work has drawn upon the expectancy-value theory (EVT; Eccles et al., 1983; Eccles, 2009) in explaining students' educational aspirations and choices. According to EVT, students form their future educational choices based on their expectancies about their capabilities to succeed (e.g., self-concept) and also, based on how much they value the specific choice (e.g., interest). Expectancies are conceptually related to and highly correlated with other constructs referring to competence beliefs (e.g., academic self-concept; the mental representation of one's personal competencies in an academic domain; Marsh & Craven, 1997) and have therefore been used interchangeably in previous studies (e.g., Guo et al., 2017; Trautwein et al., 2012). Value beliefs, on the other hand, can be divided into four components: intrinsic value (enjoyment), attainment value (perceived personal importance), utility value (perceived usefulness), and cost (perceived negative consequences) of a given task or domain (Eccles & Wigfield, 2002). However, researchers have commonly focused on one specific component or combined measures to represent overall value beliefs or interest in a specific domain (e.g., Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002).

Competence beliefs and interest have been found to be strong predictors of educational and occupational choices in both mathematics (Lauermaann, Tsai, & Eccles, 2017) and reading domains (Durik et al., 2006). They also seem to be highly domain-specific (Gaspard et al., 2018; Trautwein et al., 2012) and findings show that students tend to report higher motivation in either math or reading (Möller, Pohlmann, Köller, & Marsh, 2009). Marsh (1986) developed the Internal/External frame of reference model (I/E) to explain the patterns of low correlations between math and reading self-concepts that were observed, despite the rather high correlations between math and reading achievement. According to the I/E model, students form their domain-specific self-concepts as a function of two underlying processes: social (external) comparison and dimensional (internal) comparison. Using the external frame of reference, students compare their own achievement in a specific domain to their peers' achievement, which might lead to either positive or negative predictions from achievement to self-concept within a domain. The internal frame of reference, in turn, implies that one's achievement in a specific domain (e.g., math) is evaluated in reference to one's achievement in another domain (e.g., reading), leading to negative cross-domain predictions (Möller, Pohlman, Köller, & Marsh, 2009; Möller & Marsh, 2013). Hence, although some students perform well in both math and reading, they tend to consider themselves to be good at one or the other domain.

The cross-domain comparison processes are assumed to be one of

the reasons behind gender differences in students' educational choices. In fact, studies have consistently found that boys tend to report higher self-concept and interest in mathematics, whereas girls tend to value reading domains more, despite there being no gender differences in performance (e.g., Jacobs et al., 2002; Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005). Similar differences have been found in career aspirations as well (Lazarides & Lauer mann, 2019).

Both self-concept and interest represent personal beliefs and values that are prone to stereotypical identifications and biases (Eccles, 2009), and students' beliefs about what they should be good at and which values are desirable within their reference group are shaped by expectations and values of their culture, education, family and peer-groups (Cvencek, Meltzoff, & Greewald, 2011; Tomasetto, Mirisola, Galdi, & Cadinu, 2015). One of the most influential reference-groups that students identify with is gender, which seems to influence their motivational beliefs (Cvencek, Kapur, & Meltzoff, 2015), and possibly, as a consequence, their educational and occupational aspirations and choices as well. For example, Lazarides and Lauer mann (2019) discovered that girls' lower levels of intrinsic value in mathematics corresponded to a higher likelihood of aspiring to language-related careers, in comparison to boys.

1.2.3. School burnout

Given that recent findings reveal a decrease in students' well-being in school (Wang et al., 2015), and considering the importance of psychological factors for various educational outcomes (see e.g., Bask & Salmela-Aro, 2013; Tuominen-Soini et al., 2012), it seems relevant to examine such factors in relation to students' decision-making processes regarding their education and occupation as well. Consequently, we focus on school burnout in the present study, which can be defined as a psychological syndrome caused by long-term school-related stress and pressure to achieve (e.g., Schaufeli, Martínez, Pinto, Salanova, & Bakker, 2002). School burnout can further be divided into three sub-dimensions; exhaustion due to school demands, cynical and detached attitudes toward one's school, and feelings of inadequacy as a student (Salmela-Aro, Kiuru, Leskinen, & Nurmi, 2009). Previously, the dimensions of school burnout have been found to be differently related to several educational outcomes; feelings of cynicism and inadequacy have been linked to low academic performance and unfavorable motivational tendencies (Salmela-Aro, Kiuru, et al., 2009; Widlund, Tuominen, & Korhonen, 2018), but exhaustion has been found to occur among high-achieving and motivated students as well (Tuominen-Soini, Salmela-Aro, & Niemivirta, 2008; Tuominen-Soini et al., 2012).

Furthermore, Salmela-Aro and Upadaya (2017) found that study-related exhaustion predicted higher levels of educational aspirations and attainment, whereas elevated levels of cynicism and feelings of inadequacy were linked with lowered levels of aspirations. Overall, girls tend to report higher levels of school burnout than boys (e.g., Salmela-Aro, Savolainen, et al., 2009; Widlund, et al., 2018), and it seems that the effect on aspirations might also differ between genders; school burnout has been found to have a positive direct effect on educational aspirations for girls, but also, negative indirect effects for both genders when mediated by interest in mathematics and reading (Korhonen et al., 2016). To our knowledge, there are no previous studies addressing the relation between school burnout and occupational aspirations.

1.3. The present study

In this study, we investigated boys' and girls' pathways to educational and occupational aspirations considering two key academic domains (mathematics and reading) by including i) performance (test scores), ii) motivational beliefs (self-concept and interest), and iii) school burnout (exhaustion, cynicism, and inadequacy) as predictors. As pathways to educational and occupational aspirations have been found to differ by both gender and academic domain (e.g., Korhonen et al., 2016; Lazarides & Lauer mann, 2019; Nagy, Trautwein, Baumert,

Köller, & Garret, 2006), we further aimed to complement prior research by iv) investigating cross-domain relations between mathematics and reading domains for boys and girls.

A majority of existing studies examining aspirations have focused on mathematics (Chow et al., 2012; Watt et al., 2012) and only a few on reading (e.g., Durik et al., 2006). Even fewer have combined indicators related to both mathematics and reading (for exceptions, see Korhonen et al., 2016; Lazarides & Lauer mann, 2019; Parker et al., 2014) and, therefore, studies investigating cross-domain effects between predictors are scarce. Also, considering the relevant role of students' socio-emotional strain for various educational outcomes (e.g., school dropout: Korhonen, Linnanmäki, & Aunio, 2014), there have been surprisingly few studies investigating such factors in relation to students' educational or occupational aspirations.

The participating students were Finnish 15-year-olds studying their last year in compulsory education, who were about to face one of the most important decisions affecting their future educational and career attainment, that is, the decision regarding upper secondary education. In Finland, gender gaps still exist in many educational and occupational fields, despite the fact that both boys and girls consistently have been found to achieve top scores in mathematics and reading (OECD, 2013, 2019). At the same time, it has been suggested that students may not enjoy school (Wang et al., 2015). Therefore, including predictors representing both performance, motivational beliefs, and school burnout when examining educational and occupational aspirations in a country like Finland, provide some unique insights into students' decision-making processes regarding their future.

Our hypothetical model (Fig. 1) was constructed based on both theoretical considerations and previous empirical results. More specifically, based on the EVT (Eccles, 2009), self-concept and interest were set to directly predict aspirations within each domain, as we expected that higher levels of self-concept and interest in mathematics and reading would be related to higher levels of aspirations within the same domain. Further, given that expectancy-value constructs seem to mediate the effects between students' performance and aspirations (Guo et al., 2017; Korhonen et al., 2016), both direct and indirect relations between students' performance and aspirations were examined.

Next, in line with the I/E model (Möller et al., 2009; Möller & Marsh, 2013), we expected to find negative cross-domain effects between mathematics- and reading-related variables. More specifically, based on internal comparison processes, we expected that higher performance in one domain (e.g., reading) might be related to lower self-concept in the other domain (e.g., mathematics). Given that these cross-domain effects have been found among value beliefs as well (Gaspard et al., 2018; Guo et al., 2017), they might also, potentially, be found between domain-specific interest and occupational aspirations (Lazarides & Lauer mann, 2019).

Lastly, we expected that school burnout would be related to students' aspirations as well, so that positive effects would emerge between exhaustion and aspirations, and that cynicism and inadequacy would be related to students' aspirations negatively (Salmela-Aro & Upadaya, 2017). Since motivational beliefs have been found to mediate the relation between school burnout and educational aspirations (Korhonen et al., 2016), indirect paths through self-concept and interest were also examined.

Given that previous results regarding the moderating role of gender on educational or occupational aspirations are both mixed and scarce, no gender-specific hypotheses were set. Also, although the Finnish school system seems to provide relatively equal educational opportunities irrespective of students' sociodemographic background (OECD, 2016), socioeconomic status (SES: parents' education and occupation) was added to our model to control for the variance in mathematics and reading performance.

2. Method

2.1. Context

Compulsory schooling in Finland is comprised of primary school

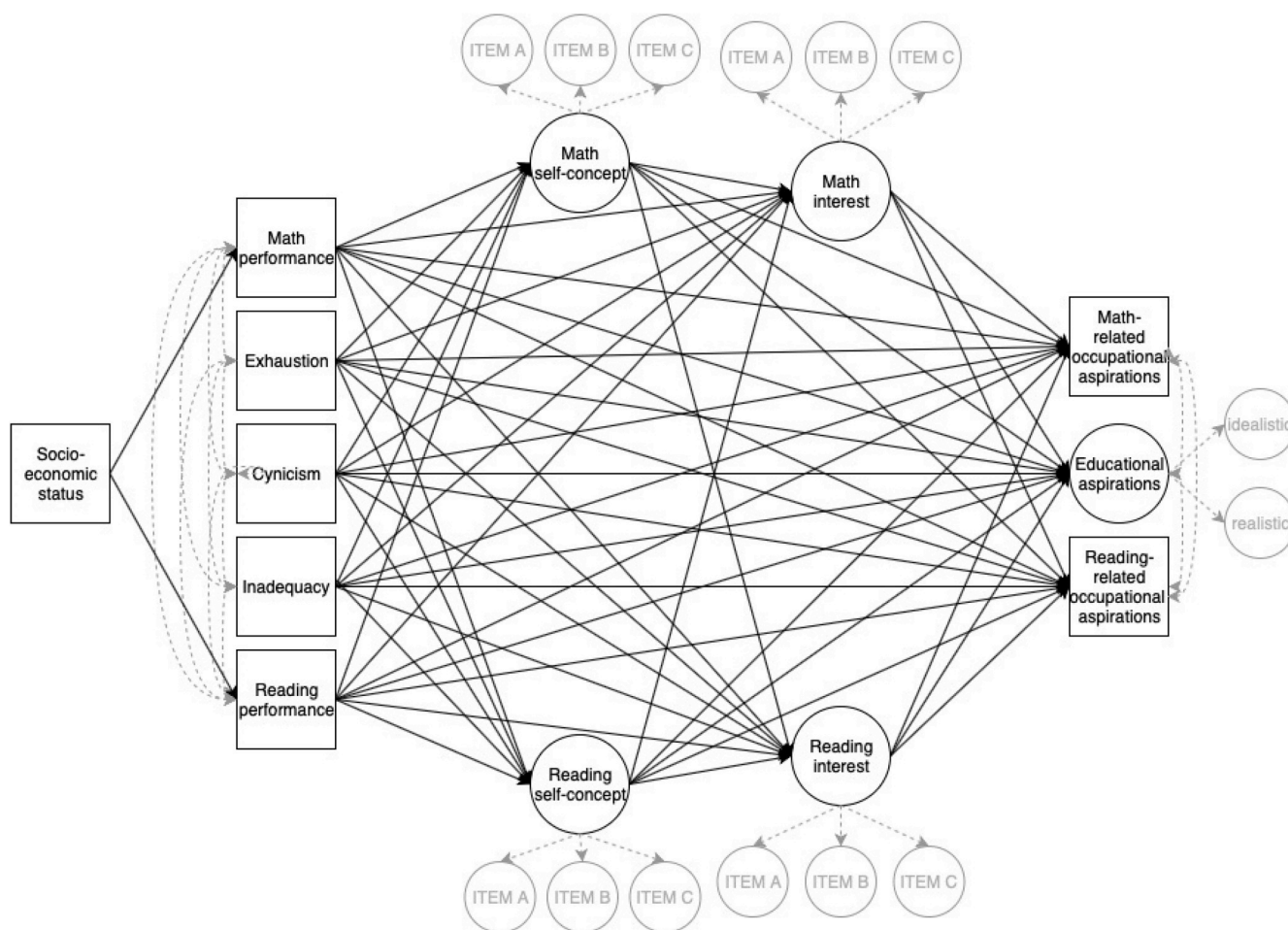


Fig. 1. Hypothetical path-model predicting educational and occupational aspirations.

(Grades 1–6) and lower secondary school (Grades 7–9). At the end of Grade 9, students can choose between general or vocational upper secondary education. After completing either general or vocational upper secondary education, students can apply for higher education.

2.2. Participants and procedure

The data came from two cohorts drawn from a longitudinal study (see Widlund, et al., 2018) with students from five lower secondary schools located in different regions of Swedish-speaking areas of Finland. Data used in this study were collected in Fall 2016 (Cohort 1), when 464 students participated (217 boys, 247 girls), and was supplemented in Fall 2018 (Cohort 2), when 502 students participated (244 boys, 258 girls). Altogether, 966 (52% girls) students in 9th grade were included in the final sample. The participating students completed a mathematics test, a reading comprehension test, and a self-report questionnaire on educational and occupational aspirations, motivational beliefs, and school burnout during three 45-min class sessions. Participation in the study was voluntary and informed consent forms were collected from the students' guardians.

2.3. Measures

2.3.1. Mathematics performance

The students' mathematical skills were assessed with a standardized online assessment test (KTLT; Räsänen, Linnanmäki, Korhonen, Kronberg, & Uppgård, 2013, see also Widlund, et al., 2018). The test consists of adaptive multiple-choice questions and open questions on basic arithmetic, applied problem solving, and algebra. It is intended

for Grades 7–9 (13–16 years). The score students obtain in the test is based on an item response theory model calculated from a nationally representative sample of students ($M = 100$, $SD = 15$).

2.3.2. Reading performance

Reading performance was assessed through the *Klassdiagnoser i läsning och skrivning för högstadiet och gymnasiet (LS)* reading ability test (Johansson, 2005). LS is a standardized test, and the subtest measuring reading comprehension intended for 15-year-olds was used to represent reading performance in this study. The test consists of five short texts. After reading the texts, the students must choose the correct title for each text from four suggestions and subsequently choose the correct alternative from six statements about the content of the text.

2.3.3. Mathematics and reading self-concept and interest

Items measuring self-concept and interest came from Marsh's (1992) Self Description Questionnaire I (SDQ I, see also Arens & Hasselhorn, 2015; Pinxten, Marsh, De Fraine, Van Den Noortgate, & Van Damme, 2014). Three items were used to assess both interest (e.g., *I like mathematics/Swedish*) and self-concept (e.g., *I learn things quickly in mathematics/Swedish*) in both domains. The items were assessed by a five-point Likert-type scale ranging from 1 (*completely false*) to 5 (*completely true*).

2.3.4. School burnout

School burnout was assessed by the School Burnout Inventory (SBI; Salmela-Aro, Kiuru, et al., 2009), using a six-point Likert-type scale ranging from 1 (*completely disagree*) to 6 (*completely agree*). The SBI scale is divided into three subscales: four items measuring emotional

exhaustion (e.g., *I feel overwhelmed by my schoolwork*), three items measuring cynicism toward the meaning of school (e.g., *I feel that I am losing interest in my schoolwork*), and two items measuring sense of inadequacy as a student (e.g., *I often have feelings of inadequacy in my schoolwork*).

2.3.5. Educational aspirations

Two statements representing students' idealistic and realistic educational aspirations were combined to represent overall educational aspirations (see e.g., Korhonen et al., 2016): *highest academic degree I want to achieve* and *highest academic degree I will probably achieve*, assessed using a 4-point ordinal scale (1 = *comprehensive education*, 2 = *vocational upper secondary education*, 3 = *university of applied sciences*, and 4 = *university*).

2.3.6. Occupational aspirations

Participants were asked to list their dream job by an open-ended question. Their aspired occupation was then coded based on how much mathematics- or reading-skills each job requires by using the O*NET (Occupational Information Network) database (National Center for O*NET Development, n.d.). The math- and reading-importance scores, each ranging from 0 (*not mathematics/reading-related*) to 100 (*completely mathematics/reading-related*) in the O*NET database were used to quantify the aspired occupation for math- and reading-relatedness.

2.3.7. Socioeconomic status

Participants were asked to list their parents' education and current occupation. The answers were then coded according to Official Statistics of Finland's (n.d.) social classification based on education and occupation. A new variable was created based on the mean score of each parents' education and occupation, to represent SES in this study.

Descriptive statistics, internal consistencies, and correlations between all variables are presented in Table 1. Mean-level gender differences were also tested through independent samples t-tests, and are presented in Appendix A.

2.4. Data analyses

Due to slight non-normality and missing data (range 1–29%) in some of the items, full information maximum likelihood with robust standard errors that uses all available information, was used as an estimator in the analyses. The structural validity of each measurement was analyzed through confirmatory factor analysis (CFA) and multiple group CFA. Next, a series of multi-group structural equation models were fitted to the data to explore the relations from performance, motivational beliefs, and school burnout to educational and occupational aspirations. All analyses were conducted using the MPLUS (version 8) program (Muthén & Muthén, 1998–2017).

The analyses started by confirming the factor structure of each measure through CFA. Next, as a prerequisite for meaningful comparison is that the measures are invariant across groups, that is, that they measure the same underlying construct(s), multiple group CFA was conducted (see Bollen, 1989). Measurement invariance was tested both for the two cohorts and for boys and girls. Based on results from the initial CFA (see Appendix B), a model was specified in which all items for each scale were allowed to load on the corresponding factor only: three factors representing school burnout (Salmela-Aro, Savolainen, et al., 2009), four factors representing self-concept and interest in mathematics and reading (Arens & Hasselhorn, 2015), and one factor representing educational aspirations (see Korhonen et al., 2016). Students' mathematics score was based on an IRT model, their reading score on their sum-score in reading comprehension, their math- and reading-related occupational aspirations on an open-ended question, and SES on their parents' mean classification score in education and occupation, and thus, these constructs were added in the model as manifest variables.

In all analyses, chi-square (χ^2), the comparative fit index (CFI: cut-off value close to > 0.95), the Tucker–Lewis Index (TLI: cut-off value close to > 0.95), and the root mean square error of approximation (RMSEA; cut-off value close to < 0.05) were used as model-fit indices (see Marsh, Hau, & Wen, 2004). When comparing nested models, it is suggested that support for the more parsimonious model requires a change in the CFI of less than 0.01 and in the RMSEA of less than 0.015 (Chen, 2007). To be able to test the significance of indirect effects, bootstrap confidence intervals (95%) with 1000 bootstrap draws were used. Lastly, the Wald chi-square test was used to test if significant path coefficients differ across genders (Wang & Wang, 2012).

3. Results

3.1. Empirical model

First, measurement invariance was tested for students participating in Cohorts 1 and 2. The baseline model, imposing no invariance constraints on the factor loadings and indicator intercepts, fitted the data well (Table 2). Next, factor loadings were constrained to equality (metric invariance) between the cohorts, and this did not worsen the model fit. Finally, we compared the metric invariance model against a fully invariant model, with both factor loadings and indicator intercepts constrained to equality (scalar invariance). The fully invariant model fitted the data well and did not worsen the model fit and, therefore, supported measurement invariance. The same procedure was conducted for testing measurement invariance for boys and girls. Similarly, measurement invariance was confirmed for boys and girls. Fit indices for all models are presented in Table 2.

Next, multi-group structural equation models were fitted to the data according to our hypothetical model shown in Fig. 1. Due to the complexity of the models, composite scores were used to represent the three sub-dimensions of school burnout.

The model fitted the data well [$\chi^2(318) = 648.184, p < 0.001$, CFI = 0.970, TLI = 0.958, RMSEA = 0.046] and explained 34% of the variance in educational aspirations, 10% of the variance in math-related occupational aspirations, and 18% of the variance in reading-related occupational aspirations for boys. For girls, the model explained 33% of the variance in educational aspirations, 10% of the variance in math-related occupational aspirations, and 12% of the variance in reading-related occupational aspirations. The boys' results are presented in Fig. 2 and girls' results in Fig. 3.

3.2. Pathways from mathematics and reading performance

Mathematics performance had a positive effect on educational aspirations for both genders, and the Wald test revealed that there was no significant difference in paths between boys and girls ($\chi^2 = 1.005, p = 0.316$). For girls, mathematics performance had an effect on both math- and reading-related occupational aspirations as well. The only direct path from reading performance was found for girls, as it was positively related to their educational aspirations.

Some indirect pathways were detected as well. Mathematics performance had an indirect effect on boys' educational aspirations ($\beta = 0.08$ 95% CI [0.03, 0.14]), math-related occupational aspirations ($\beta = 0.08$ 95% CI [0.02, 0.15]), and reading-related occupational aspirations ($\beta = 0.06$ 95% CI [0.01, 0.12]) mediated by self-concept and interest in mathematics. For girls, indirect effects were also found from mathematics performance to educational aspirations, through mathematics self-concept and interest ($\beta = 0.05$ 95% CI [0.01, 0.10]) and, also from reading performance to educational aspirations through reading self-concept ($\beta = 0.05$ 95% CI [0.01, 0.09]).

3.3. Pathways from motivational beliefs

The only direct paths from students' domain-specific self-concepts

Table 1
Correlations, descriptive statistics, and internal consistencies for all measures at cohorts 1 and 2 for boys and girls.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	Boys M (SD)	Girls M (SD)
1 Mathematics performance	1/1	.44*/.55*	.53*/.50*	.24*/.26*	.41*/.44*	.12/.14*	-.07/.00	-.06/-.27*	-.20*/-.14*	.28*/.52*	.09/.27*	.18*/.39*	.30*/.33*	109.1/110.6 (17.2/16.8)	108.8/107.3 (14.1/14.6)
2 Reading performance	.48*/.56*	1/1	.26*/.40*	.31*/.38*	.23*/.36*	.27*/.26*	.03/.09	-.02/-.30*	-.09/-.06	.26*/.43*	.20*/-.02	.18*/.14	.26*/.27*	11.0/10.3 (4.4/4.3)	12.6/11.3 (3.5/4.1)
3 Mathematics self-concept	.53*/.64*	.34*/.44*	1/1	.16*/.25*	.65*/.69*	.09/.11	-.28*/-.16*	-.27*/-.29*	-.36*/-.27*	.23*/.38*	.09/.26*	.04/.19*	.23*/.26*	3.6/3.6 (0.97/0.94)	3.4/3.1 (0.97/1.0)
4 Reading self-concept	.19*/.23*	.29*/.27*	.27*/.30*	1/1	.13/.20*	.60*/.62*	-.13*/.01	-.23*/-.27*	-.18*/-.09	.30*/.29*	.02/-.07	.22*/.16*	.35*/.27*	3.5/3.4 (0.90/0.91)	3.8/3.7 (0.83/0.94)
5 Mathematics interest	.43*/.60*	.35*/.38*	.64*/.73*	.18*/.29*	1/1	.28*/.27*	-.14*/-.12	-.30*/-.34*	-.32*/-.25*	.31*/.37*	.13/.20*	.09/.11	.15*/.23*	2.9/2.9 (1.1/1.2)	2.6/2.6 (1.1/1.1)
6 Reading interest	.09/.18*	.23*/.14	.13/.26*	.67*/.67*	.26*/.44*	1/1	.04/-.01	-.22*/-.31*	-.09/-.10	.28*/.19*	.03/.02	.23*/.05	.17*/.12	2.9/2.9 (0.98/1.1)	3.5/3.1 (1.0/1.1)
7 Exhaustion	-.11/-.12	-.10/-.21*	-.16*/-.30*	-.01/-.20*	-.12/-.19*	.01/-.11	1/1	.54*/.46*	.64*/.64*	.04/.06	-.22/-.06	.06/-.02	-.03/-.18*	2.5/2.4 (1.1/1.2)	3.2/3.3 (1.1/1.2)
8 Cynicism	-.14*/-.20*	-.16*/-.34*	-.14*/-.30*	-.16*/-.34*	-.22*/-.37*	-.17*/-.37*	.65*/.67*	1/1	.56*/.63*	-.19*/-.26*	-.17*/-.21*	-.01/-.17*	-.08/-.10	2.6/2.6 (1.2/1.3)	2.7/2.8 (1.2/1.3)
9 Inadequacy	-.15*/-.19*	-.17*/-.32*	-.15*/-.32*	-.09/-.25*	-.18*/-.32*	-.10/-.29*	.69*/.74*	1/1	.69*/.76*	-.24*/-.12	-.25*/-.10	-.11/-.10	-.17*/.07	2.7/2.8 (1.2/1.3)	3.4/3.5 (1.3/1.3)
10 Educational aspirations	.30*/.45*	.32*/.32*	.33*/.50*	.24*/.31*	.39*/.53*	.28*/.30*	.07/-.10	-.21*/-.30*	-.07/-.19*	1/1	.15*/.17*	.36*/.39*	.50*/.35*	3.2/3.2 (0.82/0.82)	3.2/3.3 (0.78/0.82)
11 Math-related occupational aspirations	.18*/.22*	.08/.08	.15/.23*	.03/.11*	.16*/.30*	.08/.07	-.08/-.00	.04/-.10	-.12/-.08	.31*/.31*	1/1	.18*/.19*	.17*/.06	42.9/44.2 (15.2/17.6)	39.3/39.1 (12.6/15.4)
12 Reading-related occupational aspirations	.33*/.26*	.29*/.19*	.30*/.27*	.26*/.16*	.36*/.31*	.30*/.20*	.07/-.09	-.11/-.22*	-.10/-.15*	.59*/.56*	.50*/.48*	1/1	.35*/.10	66.6/64.3 (12.6/12.0)	71.3/69.6 (10.6/10.7)
13 Socioeconomic status	.26*/.37*	.22*/.34*	.18*/.25*	.20*/.31*	.27*/.25*	.19*/.23*	.02/.03	-.09/-.12	-.04/-.03	.41*/.41*	.06/.07	.36*/.30*	1/1	2.4/2.3 (0.55/0.59)	2.4/2.4 (0.61/0.59)
Cronbach's alpha	-	-	.93/.93	.92/.92	.91/.93	.90/.92	.76/.94	.75/.95	.66/.85	.88/.89	-	-	-	-	-

Note. Correlation coefficients to the left side of the diagonal refer to boys and the right side to girls. Correlation coefficients for Cohorts 1 and 2 are separated by slash.

*p < 0.05.

Table 2
Goodness of fit statistics for alternative models.

	Model	χ^2	df	CFI	TLI	RMSEA	Δ CFI	Δ RMSEA	p
Cohort 1 and Cohort 2	Configural	667.515	404	.980	.975	.037			.000
	Metric	679.480	419	.980	.976	.036	.000	.001	.000
	Scalar	711.159	434	.979	.975	.036	.001	.000	.000
Boys and girls	Configural	671.525	404	.979	.974	.037			.000
	Metric	702.620	419	.978	.973	.037	.001	.001	.000
	Scalar	775.786	434	.973	.969	.040	.005	.003	.000

was found from girls' reading self-concept. Girls' reading self-concept was positively related to their educational aspirations but had a negative effect on their math-related occupational aspirations. Regarding interest, mathematics interest was related to educational aspirations for both genders, and these regression coefficients did not differ between genders ($\chi^2 = 0.540, p = 0.462$). Mathematics interest was also linked to boys' math- and reading-related occupational aspirations, but no statistically significant paths from reading interest were found.

Some indirect effects were also detected for both genders. Mathematics self-concept had an indirect effect, through interest in mathematics, on educational aspirations for both boys ($\beta = 0.16$ 95% CI [0.05, 0.27]) and girls ($\beta = 0.12$ 95% CI [0.01, 0.23]), but it only predicted math-related occupational aspirations indirectly for boys ($\beta = 0.16$ 95% CI [0.05, 0.28]).

3.4. Pathways across domains

No negative cross-domain effects were found between performance and self-concept. Instead, a positive effect was found between reading

performance and mathematics self-concept for girls. Cross-domain effects were also detected between motivational beliefs and aspirations: a positive effect was found between boys' mathematics interest and their reading-related occupational aspirations, and a negative path emerged between reading self-concept and math-related occupational aspirations for girls. A small negative path also emerged between girls' reading performance and their math-related occupations, mediated by reading self-concept ($\beta = -0.08$ 95% CI [-0.14, -0.02]).

3.5. Pathways from school burnout

The three dimensions of school burnout were differently related to students' educational and occupational aspirations. Exhaustion had positive direct effects on boys' and girls' educational aspirations, and there were no differences in the paths across genders ($\chi^2 = 0.000, p = 1.000$). For boys, exhaustion was related to their reading-related occupational aspirations as well, and cynicism affected educational aspirations negatively, and equally, for boys and girls ($\chi^2 = 1.741, p = 0.187$). Inadequacy also had a negative effect on educational

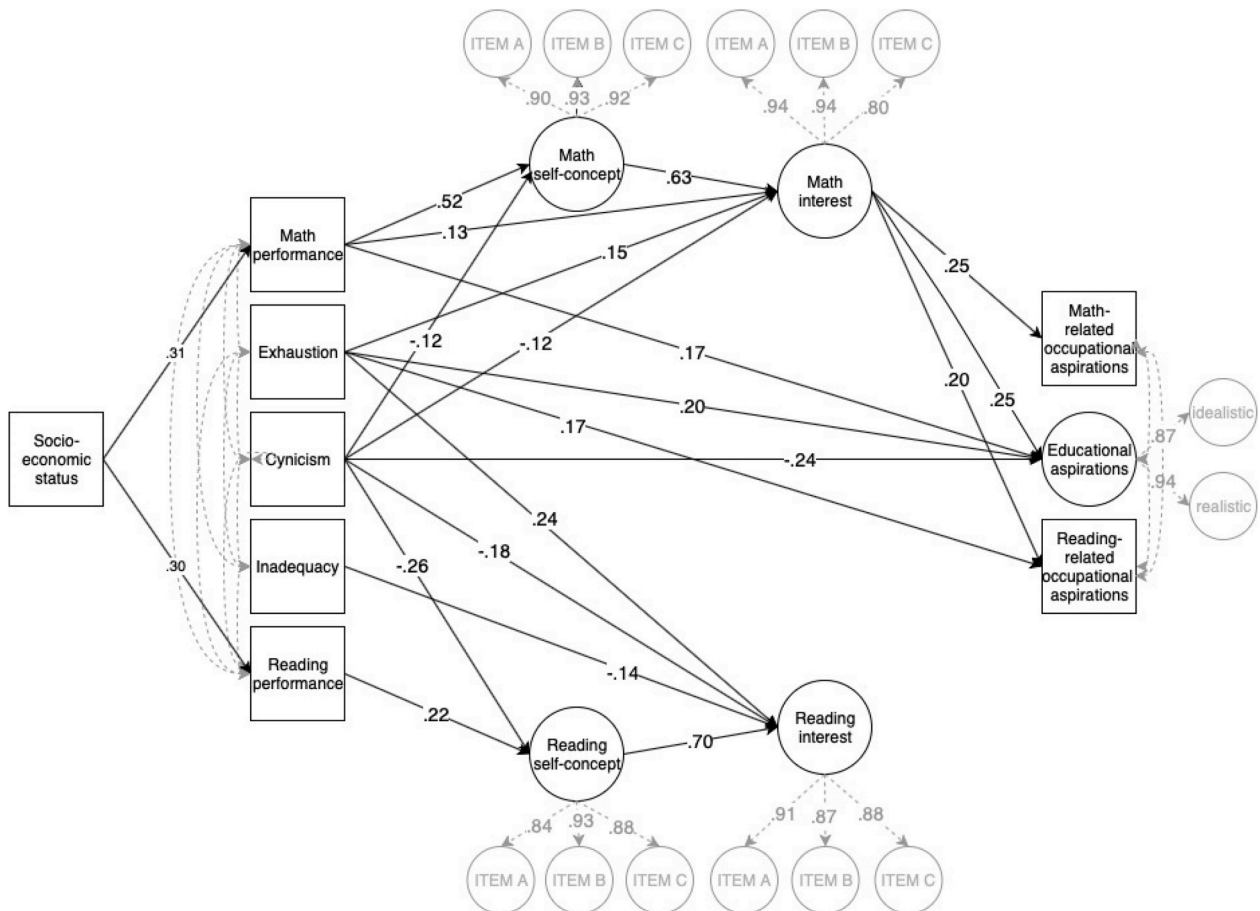


Fig. 2. Empirical model: boys' significant ($p < 0.05$) pathways to educational and occupational aspirations.

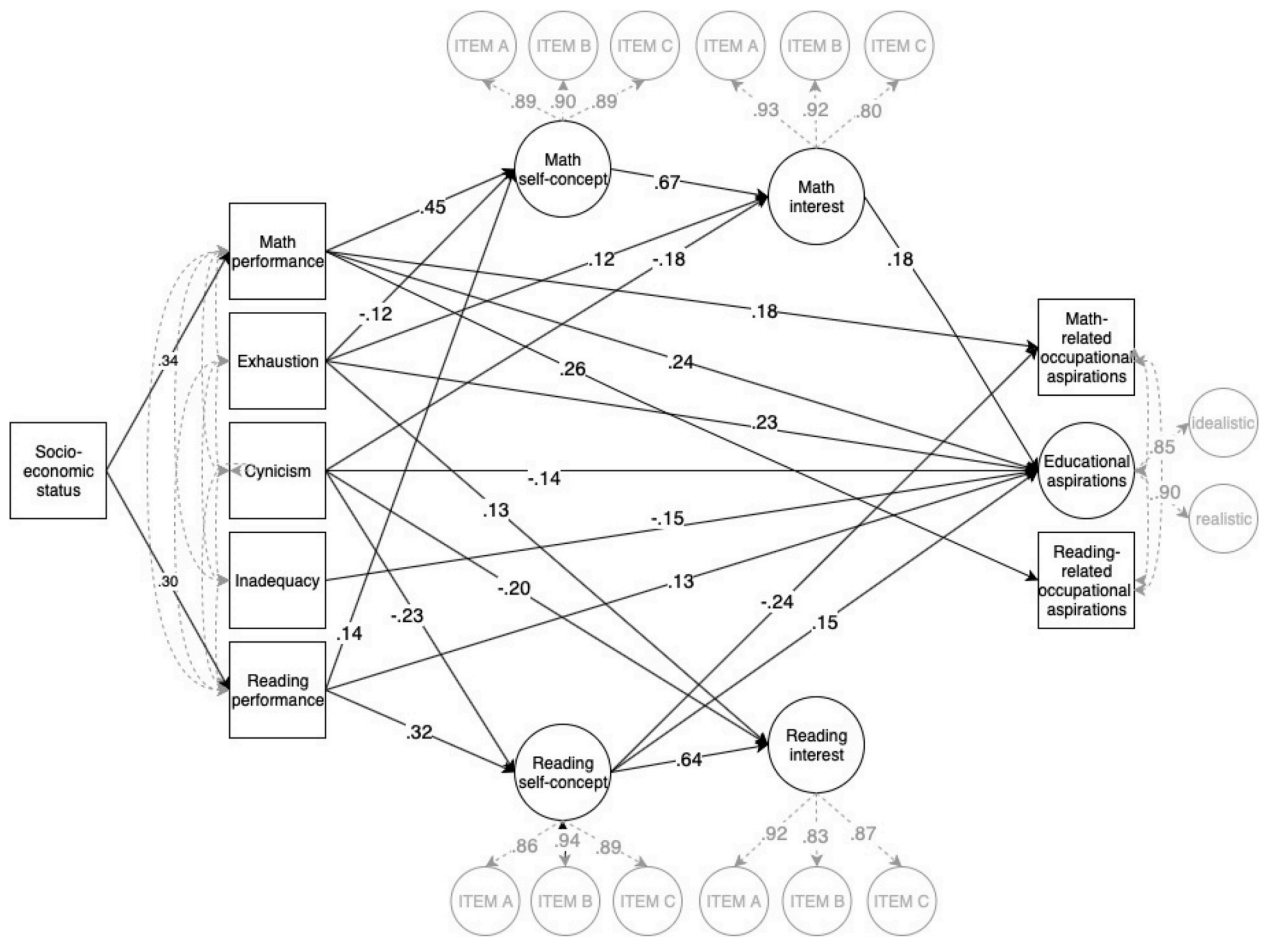


Fig. 3. Empirical model: girls' significant ($p < 0.05$) pathways to educational and occupational aspirations.

aspirations for girls. No direct effects were found from neither cynicism nor inadequacy to students' occupational aspirations.

Some indirect relations were found as well. For boys, exhaustion was related to educational aspirations indirectly through mathematics interest ($\beta = 0.04$ 95% CI [-0.14, -0.02]). For girls, on the other hand, cynicism was related to educational aspirations, mediated by their reading self-concept ($\beta = -0.04$ 95% CI [-0.07, -0.001]), and also to math-related occupational aspirations, mediated by their reading self-concept ($\beta = 0.06$ 95% CI [0.01, 0.11]).

4. Discussion

The aim of this study was to investigate gender differences in how performance, motivational beliefs, and school burnout relate to educational and occupational aspirations among adolescent students facing the transition to upper secondary education. We contributed to previous knowledge by i) examining performance and motivational predictors in the key academic domains of mathematics and reading, ii) by investigating pathways to both domain-general educational aspirations and domain-specific occupational aspirations, iii) by studying cross-domain relations between the two domains, and also iv) by including school burnout among the predictive variables. To our knowledge, school burnout has not previously been linked with students' occupational aspirations. Overall, our findings are in line with our expectations based on the EVT and previous empirical studies (e.g., Korhonen et al., 2016; Nagy et al., 2006) and, both similarities and differences between boys' and girls' pathways to educational and occupational aspirations were found.

First, mathematics performance seemed to be rather important for

students' aspired educational degrees and occupational plans in general. In fact, mathematics performance seemed equally important for boys' and girls' educational aspirations, and was also related to both math- and reading-related occupational aspirations, directly for girls and indirectly for both genders. Parker et al. (2014) found similar results; students performing well in mathematics also chose careers in biological, medical, law-, and business-related fields. Overall, these results suggest that students who perform well in mathematics, also aspire to higher educational degrees, and that mathematics performance also seems to be an important predictor of occupational aspirations, regardless of whether the aspired job involves mathematics or reading skills.

Reading performance, in turn, did not seem to be as important in shaping students' – and especially boys' – aspirations. These results are partly supported by those found by Korhonen et al. (2016), as they detected no direct relations between boys' reading performance and their educational aspirations either, but only indirect effects, through interest. Reading did, however, in line with previous findings (Korhonen et al., 2016), have a small effect on girls' aspired educational degrees. Thus, it might be that reading performance only matters for the general level of education girls aspire to, but not necessarily the domain-specific choices they make regarding their future.

In sum, both mathematics and reading performance seemed to be related to the educational degrees girls aspire to, whereas only mathematics played a role among boys. However, given that mathematics performance was related to both math- and reading-related occupational aspirations for both genders, it could be regarded as a slightly more important factor in shaping students' career goals in general. Our results also confirm previous findings, suggesting that

motivational beliefs mediate the relationship between achievement and aspirations (e.g., Guo et al., 2017). Such indirect relations were found in the reading domain for girls, and in the mathematics domain for both genders, indicating that students who perform well, are also likely to have higher self-concept and show more interest in the same domain, which supports their educational and occupational aspirations.

Next, in line with the literature (Eccles, 2009; Eccles et al., 1983), we found support for the EVT when investigating pathways from motivational beliefs to students' aspirations, although there were some differences between genders. Again, motivational factors in both mathematics and reading domains were associated with girls' aspired educational degrees, whereas math-related beliefs were clearly more important for boys. In fact, boys' educational and math- and reading-related occupational aspirations were all directly predicted by their interest in mathematics and indirectly by their mathematics self-concept. These mediating effects from self-concept through interest are similar to those found by Guo et al. (2015), and might indicate that although self-concept is important for setting high educational goals, it might not necessarily lead to higher levels of aspirations, if one does not also value the subject.

Regarding gender differences, the results are similar to those found by Korhonen et al. (2016) and Viljaranta, Nurmi, Aunola, and Salmela-Aro (2009), indicating that mathematics, and especially math-specific motivational beliefs, seem to be particularly important in shaping boys' aspirations, both regarding their aspired educational degree and occupational choice, irrespective of the domain. They also align with gender-typical biases (Meece, Glienke, & Burg, 2006), implying that boys typically show more confidence in and place more value on mathematics than, for example, reading. Although previous findings imply that similar gendered stereotypes might exist among girls with respect to reading (Jacobs et al., 2002), we did not find any clear evidence of such patterns in our study, as performance and motivation in both mathematics and reading played a role in girls' educational aspirations. However, given that previous studies have rarely investigated gendered pathways to aspirations across academic domains, these findings could be taken to emphasize the importance of including several domains in the study designs. Consequently, it seems that the formation of girls' aspirations might be influenced by several different factors across academic domains, whereas boys' aspirations might mostly be influenced by their math-related performance and motivation, regardless of the aspired occupational domain.

In addition, when examining cross-domain relations, we found that higher levels of reading self-concept for girls was related to lower math-related occupational aspirations. Similar negative relations have been found between verbal self-concept and mathematics interest previously as well (e.g., Gaspard et al., 2018). In line with the I/E model (e.g., Möller & Marsh, 2013) and gender-typical comparison processes, this could partly explain why there are significantly fewer women choosing to both study and work in math-related fields, despite their rather high mathematics performance. It could be that girls identify more strongly with the reading domain, which, in turn, negatively impacts their occupational aspirations in math-related fields. Parker et al. (2014) detected similar stereotyped self-evaluations, as they found that girls with high levels of English self-concept and low levels of mathematics self-concept were significantly less likely to enter math- and science-related occupational fields, even after controlling for performance. Interestingly, Lazarides and Lauer mann (2019) detected a similar, yet more unexpected cross-domain effect: girls interested in mathematics were less likely to aspire to language-related jobs. Also, in concurrence with our results, no negative cross-domain relations were detected among boys. It seems that girls' domain-specific aspirations might be more influenced by their motivational beliefs in other fields, whereas boys' values and perceptions about competence might not be as negatively linked between domains.

Contrary to our expectations, positive cross-domain relations were found as well; boys interested in mathematics, were aspiring to both

math- and reading-related jobs. We also found that reading performance was positively related to girls' mathematics self-concept, although the effect was rather small. It has previously been demonstrated that correlations between achievement and competence beliefs are stronger if the achievement variable is represented by grades rather than test scores (Möller & Marsh, 2013). Another possible explanation could be that reading performance in our study is represented by reading-comprehension, a skill that is also highly relevant for performing many math-related tasks, such as math word-problem solving (Fuchs, Fuchs, Seethaler, & Craddock, 2019).

Lastly, concerning school burnout, our results largely concur with those previously found by Salmela-Aro and Upadyaya (2017). Feelings of exhaustion appeared to be positively related to both boys' and girls' aspired educational degrees, indicating that more ambitious aspirations, at least to some extent, are related to higher levels of exhaustion. Although aspirations for higher educational degrees might "pay off" as they may lead to actual attainment, there might also be possible costs of having higher aspirations. Students who set more ambitious educational and occupational goals presumably also work hard to achieve these goals, which might, in turn, result in emotional exhaustion. This possibility should be taken seriously, considering that prolonged feelings of exhaustion may lead to depressive symptoms later on (Salmela-Aro, Savolainen, et al., 2009).

Further, cynical attitudes towards school and feelings of inadequacy as a student were, as expected, associated with lower levels of educational aspirations for both genders. However, it seems that the negative aspects of school burnout mostly affected students' more short-term aspirations concerning educational degrees. Nevertheless, the fact that several significant pathways were found from school burnout to both boys' and girls' aspirations even after controlling for performance and motivational beliefs, emphasizes the importance of considering students' socio-emotional strain and feelings towards school when investigating the formation of their aspirations. These results clearly indicate that students' experiences of school burnout may interfere with their thoughts about possible future educational degrees; higher experiences of cynicism and inadequacy seem to be associated with lower academic goals. It would be important to acknowledge students' burnout, especially among girls, given that girls express higher levels of school burnout than boys (Salmela-Aro, Savolainen, et al., 2009, see also Appendix A).

4.1. Practical implications

The results of the present study can be taken to emphasize the importance of taking into account several factors when supporting students' career-planning. Considering that performance, motivational beliefs, and well-being all clearly matter for students educational and occupational aspirations, problems in any of these should be recognized and support provided. Also, considering that students' domain-specific aspirations may be influenced by their performance, competence beliefs and values in other domains, teachers and parents should acknowledge such cross-domain patterns when supporting students' decision-making processes. This could be particularly important for girls, as their motivational beliefs and aspirations in different domains seem to be more negatively interlinked, and might therefore unnecessarily narrow down their aspired career alternatives.

Although in our study it was revealed that girls performing well in mathematics aspire to both math- and reading-related jobs, the prevalent situation in most math-related fields is that large gender-gaps still exist. It might be that girls opt out of their math-related career aspirations later on as they approach the actual decision, possibly partly due to stereotyped comparison processes. Therefore, resources should be targeted to enhancing girls' aspirations and choices towards math-related fields by strengthening their math-related motivational beliefs. This would be important, considering that girls consistently seem to have lower levels of competence beliefs and values towards

mathematics in comparison to boys, despite there being no difference in performance (e.g., Marsh et al., 2005). Although there are no clear instructions for practice, research suggests that explaining the relevance and usefulness of the learning content might be particularly important for girls' aspirations (Gaspard et al., 2015; Watt et al., 2012) together with providing female role-models in math-related fields (Else-Quest et al., 2010).

Further, it is important to acknowledge the possible strain students' negative feelings towards school might have on their aspirations, and also, the potential emotional cost of having ambitious aspirations. Although schools already acknowledge the importance of supporting students' academic challenges, less attention has been paid to supporting their academic well-being. Our results indicate that students' experiences of emotional strain may affect their aspirations and decisions concerning their future education, and thus, students' well-being should be supported as well. Schools should, for example, provide school counseling focusing on enhancing adequate coping-strategies to help students in preventing and handling possible feelings of exhaustion, especially as these are likely to increase in the course of the studies.

4.2. Limitations and future directions

When interpreting the results, some limitations should be considered. First, it should be noted that this study is cross-sectional. In order to better understand the developmental processes of how students' aspirations are formed, longitudinal studies following students through secondary and tertiary education should be conducted. The interpretation of the results should also be made cautiously, considering that cross-sectional data may lead to overestimation of effects (Maxwell, Cole, & Mitchell, 2011). Second, although the results from the present study largely align with theoretical assumptions (EVT; Eccles et al., 1983) and previous empirical results (e.g., Lazarides & Lauermann, 2019), the context of the study (i.e., the Finnish school system) should be acknowledged when interpreting them. Considering that both similarities and differences in the mean levels and structural relations in students' motivational beliefs and educational aspirations have been identified when comparing culturally different school systems (e.g., Canada, Australia, and the United States; Watt et al., 2012), future research should pay even more attention to cross-cultural comparisons when investigating students' aspirations. Also, given that we focused only on students' interest, other aspects of value beliefs (e.g., attainment value, utility value, and perceived cost) and positive indicators reflecting students' well-being (e.g., schoolwork engagement)

Appendix A

Table A1
Observed mean differences between boys and girls for all measures.

	Boys <i>M</i> (<i>SD</i>)	Girls <i>M</i> (<i>SD</i>)	<i>t</i>	<i>df</i>	<i>p</i>	Cohen's <i>d</i>
Mathematics performance	109.8 (17.0)	108.1 (14.3)	1.530	799.257	0.124	
Reading performance	10.7 (4.4)	12.0 (3.9)	4.747	790.442	0.000	0.33
Mathematics self-concept	3.6 (1.0)	3.2 (1.0)	5.817	957.000	0.000	0.38
Reading self-concept	3.5 (0.9)	3.8 (0.9)	5.119	958.000	0.000	0.33
Mathematics interest	2.9 (1.2)	2.6 (1.1)	4.370	949.000	0.000	0.28
Reading interest	2.9 (1.0)	3.3 (1.1)	5.966	954.000	0.000	0.39
Exhaustion	2.5 (1.1)	3.2 (1.2)	10.261	943.880	0.000	0.67
Cynicism	2.6 (1.2)	2.8 (1.2)	2.243	949.000	0.025	0.15
Inadequacy	2.8 (1.3)	3.5 (1.3)	8.591	943.000	0.000	0.56
Educational aspirations	3.2 (0.8)	3.3 (0.8)	1.470	922.000	0.142	
Math-related occupational aspirations	43.5 (16.5)	39.2 (14.0)	3.674	639.452	0.000	0.28
Reading-related occupational aspirations	65.4 (12.4)	70.5 (10.7)	5.727	643.027	0.000	0.44

should be addressed as well. This would be particularly important regarding girls' aspirations, as they seemed to be slightly more negatively affected by girls' feelings of school burnout and by motivational beliefs across domains.

5. Conclusions

Taken together, our results largely concurred with previous findings, and demonstrated that performance, motivational beliefs, and school burnout all contribute to the educational degrees and occupations students aspire to. For girls, aspirations seemed to be steered by several different factors across academic domains, whereas math-related performance and motivation were more important for boys. The results also indicated that girls' math-related occupational aspirations may be negatively linked with their reading self-concept, but no negative cross-domain relations were detected among boys. However, for both genders, higher levels of educational aspirations were related to higher levels of school-related exhaustion, whereas feelings of cynicism and inadequacy in school were related to lower levels of aspirations. These findings demonstrate that resources are needed to support not only students' performance, but also their motivation and well-being, in order to help them in their goal-setting and career planning.

CRedit authorship contribution statement

Anna Widlund: Conceptualization, Methodology, Formal analysis, Investigation, Writing - original draft. **Heta Tuominen:** Conceptualization, Methodology, Writing - review & editing, Supervision. **Anna Tapola:** Writing - review & editing. **Johan Korhonen:** Conceptualization, Methodology, Investigation, Writing - review & editing, Supervision, Project administration.

Declaration of competing interest

None.

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Appendix B

Table B1

Nested model comparisons for the Self Description Questionnaire I (SDQ-I) and the school burnout inventory.

Measurement	Factor(s)	χ^2	df	CFI	TLI	RMSEA	p
SDQ-I Mathematics	1	1286.906	9	.668	.447	.384	.0000
	2	16.226	8	.998	.996	.033	.0393
SDQ-I Reading	1	872.241	9	.694	.491	.316	.0000
	2	31.961	8	.992	.984	.056	.0000
School Burnout Inventory	1	403.308	27	.868	.824	.121	.0000
	3	94.722	24	.975	.963	.055	.0000

References

- Arens, A. K., & Hasselhorn, M. (2015). Differentiation of competence and affect self-perceptions in elementary school students: Extending empirical evidence. *European Journal of Psychology of Education, 30*, 405–419. <https://doi.org/10.1007/s10212-015-0247-8>.
- Armstrong, P. I., & Crombie, G. (2000). Compromises in adolescents' occupational aspirations and expectations from grades 8 to 10. *Journal of Vocational Behavior, 56*, 82–98. <https://doi.org/10.1006/jvbe.1999.1709>.
- Bask, M., & Salmela-Aro, K. (2013). Burned out to drop out: Exploring the relationship between school burnout and school dropout. *European Journal of Psychology of Education, 28*, 511–528. <https://doi.org/10.1007/s10212-012-0126-5>.
- Bollen, K. A. (1989). *Structural equations with latent variables*. Hoboken, NJ: Wiley.
- Chen, F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling: A Multidisciplinary Journal, 14*, 464–504. <https://doi.org/10.1080/10705510701301834>.
- Chow, A., Eccles, J. S., & Salmela-Aro, K. (2012). Task value profiles across subjects and aspirations to physical and IT-related sciences in the United States and Finland. *Developmental Psychology, 48*, 1612–1628. <https://doi.org/10.1037/a0030194>.
- Cvencek, D., Kapur, M., & Meltzoff, A. N. (2015). Math achievement, stereotypes, and math self-concepts among elementary-school students in Singapore. *Learning and Instruction, 39*, 1–10. <https://doi.org/10.1016/j.learninstruc.2015.04.002>.
- Cvencek, D., Meltzoff, A. N., & Greenwald, A. G. (2011). Math-gender stereotypes in elementary school children. *Child Development, 82*, 766–779. <https://doi.org/10.1111/j.1467-8624.2010.01529.x>.
- Durik, A. M., Vida, M., & Eccles, J. S. (2006). Task values and ability beliefs as predictors of high school literacy choices: A developmental analysis. *Journal of Educational Psychology, 98*, 382–393. <https://doi.org/10.1037/0022-0663.98.2.382>.
- Eccles, J. S. (2009). Who am I and what am I going to do with my life? Personal and collective identities as motivators of action. *Educational Psychologist, 44*, 78–89. <https://doi.org/10.1080/00461520902832368>.
- Eccles, J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., & Meece, J. L. (1983). Expectancies, values and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motives* (pp. 74–146). San Francisco, CA: W. H. Freeman.
- Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology, 53*, 109–132. <https://doi.org/10.1146/annurev.psych.53.100901.135153>.
- Else-Quest, N. M., Hyde, J. S., & Linn, M. C. (2010). Cross-national patterns of gender differences in mathematics: A meta-analysis. *Psychological Bulletin, 136*, 103–127. <https://doi.org/10.1037/a0018053>.
- Fuchs, L., Fuchs, D., Seethaler, P. M., & Craddock, C. (2019). Improving language comprehension to enhance word-problem solving. *Reading and Writing Quarterly*. <https://doi.org/10.1080/10573569.2019.1666760>.
- Gaspard, H., Dicke, A.-L., Flunger, B., Brisson, B. M., Häfner, I., Nagengast, B., et al. (2015). Fostering adolescents' value beliefs for mathematics with a relevance intervention in the classroom. *Developmental Psychology, 51*, 1226–1240. <https://doi.org/10.1037/dev0000028>.
- Gaspard, H., Wigfield, A., Jiang, Y., Nagengast, B., Trautwein, U., & Marsh, H. W. (2018). Dimensional comparisons: How academic track students' achievements are related to their expectancy and value beliefs across multiple domains. *Contemporary Educational Psychology, 52*, 1–14. <https://doi.org/10.1016/j.cedpsych.2017.10.003>.
- Gottfredson, L. S. (1981). Circumscription and compromise: A developmental theory of occupational aspirations. *Journal of Counseling Psychology, 28*, 545–579. <https://doi.org/10.1037/0022-0167.28.6.545>.
- Guo, J., Marsh, H. W., Morin, A. J. S., Parker, P. D., & Kaur, G. (2015). Directionality of the associations of high school expectancy-value, aspirations, and attainment: A longitudinal study. *American Educational Research Journal, 52*, 371–402. <https://doi.org/10.3102/0002831214565786>.
- Guo, J., Marsh, H. W., Parker, P. D., Morin, A. J. S., & Dicke, T. (2017). Extending expectancy value theory predictions of achievement and aspirations in science: Dimensional comparison processes and expectancy-by-value interactions. *Learning and Instruction, 49*, 81–91. <https://doi.org/10.1016/j.learninstruc.2016.12.007>.
- Jacobs, J. E., Lanza, S., Osgood, D. W., Eccles, J. S., & Wigfield, A. (2002). Changes in children's self-competence and values: Gender and domain differences across grades one through twelve. *Child Development, 73*, 509–527. <https://doi.org/10.1111/1467-8624.00421>.
- Johansson, M.-G. (2005). *LS. Handledning. Klassdiagnoser i läsning och skrivning för högstadiet och gymnasiet [LS. Manual. Diagnostics in reading and writing for middle school and upper secondary students]*. Stockholm: Psykologiförlaget.
- Korhonen, J., Linnanmäki, K., & Aunio, P. (2014). Learning difficulties, academic well-being and educational dropout: A person-centred approach. *Learning and Individual Differences, 31*, 1–10. <https://doi.org/10.1016/j.lindif.2013.12.011>.
- Korhonen, J., Tapola, A., Linnanmäki, K., & Aunio, P. (2016). Gendered pathways to educational aspirations: The role of academic self-concept, school burnout, achievement and interest in mathematics and reading. *Learning and Instruction, 46*, 21–33. <https://doi.org/10.1016/j.learninstruc.2016.08.006>.
- Lauermaann, F., Tsai, Y., & Eccles, J. S. (2017). Math-related career aspirations and choices within Eccles et al.'s expectancy-value theory of achievement-related behaviors. *Developmental Psychology, 53*, 1540–1559. <https://doi.org/10.1037/dev0000367>.
- Lazarides, R., & Lauermaann, F. (2019). Gendered paths into STEM-related and language-related careers: Girls' and boys' motivational beliefs and career plans in math and language arts. *Frontiers in Psychology, 10*, 1243. <https://doi.org/10.3389/fpsyg.2019.01243>.
- Marks, G. N. (2008). Accounting for the gender gaps in student performance in reading and mathematics: Evidence from 31 countries. *Oxford Review of Education, 34*, 89–109. <https://doi.org/10.1080/03054980701565279>.
- Marsh, H. W. (1986). Verbal and math self-concepts: An internal/external frame of reference model. *American Educational Research Journal, 23*, 129–149. <https://doi.org/10.3102/00028312023001129>.
- Marsh, H. (1992). *Self description questionnaire (SDQ) I: A theoretical and empirical basis for the measurement of multiple dimensions of late adolescent self-concept: A test manual and a research monograph*. NSW: University of Western Sydney.
- Marsh, H. W., Abdulkabbar, A. S., Parker, P. D., Morin, A. J. S., Abdelfattah, F., & Nagengast, B. (2015). The internal/external frame of reference model of self-concept and achievement relations: Age-cohort and cross-cultural differences. *American Educational Research Journal, 52*, 168–202. <https://doi.org/10.3102/0002831214549453>.
- Marsh, H. W., & Craven, R. (1997). Academic self-concept: Beyond the dustbowl. In G. D. Phye (Ed.), *Handbook of classroom Assessment* (pp. 131–198). San Diego, CA: Academic Press.
- Marsh, H. W., Hau, K. T., & Wen, Z. (2004). In search of golden rules: Comment on hypothesis-testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler's (1999) findings. *Structural Equation Modeling: A Multidisciplinary Journal, 11*, 320–341. <https://doi.org/10.1207/s15328007sem1103.2>.
- Marsh, H. W., Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2005). Academic self-concept, interest, grades, and standardized test scores: Reciprocal effects models of causal ordering. *Child Development, 76*, 397–416. <https://doi.org/10.1111/j.1467-8624.2005.00853.x>.
- Mau, W. C., & Bikos, L. H. (2000). Educational and vocational aspirations of minority and female students: A longitudinal study. *Journal of Counseling & Development, 78*, 186–194. <https://doi.org/10.1002/j.1556-6676.2000.tb02577.x>.
- Maxwell, S. E., Cole, D. A., & Mitchell, M. A. (2011). Bias in cross-sectional analyses of longitudinal mediation: Partial and complete mediation under an autoregressive model. *Multivariate Behavioral Research, 46*, 816–841. <https://doi.org/10.1080/00273171.2011.606716>.
- Meece, J. L., Glienke, B. B., & Burg, S. (2006). Gender and motivation. *Journal of School Psychology, 44*, 351–373. <https://doi.org/10.1016/j.jsp.2006.04.004>.
- Mendez, L. M. R., & Crawford, K. M. (2002). Gender-role stereotyping and career aspirations: A comparison of gifted early adolescent boys and girls. *Journal of Secondary Gifted Education, 13*, 96–107. <https://doi.org/10.4219/jsge-2002-375>.
- Möller, J., & Marsh, H. W. (2013). Dimensional comparison theory. *Psychological Review, 120*, 544–560. <https://doi.org/10.1037/a0032459>.
- Möller, J., Pohlman, B., Köller, O., & Marsh, H. W. (2009). A meta-analytic path analysis of the internal/external frame of reference model of academic achievement and academic self-concept. *Review of Educational Research, 79*, 1129–1167. <https://doi.org/10.3102/0034654309337522>.
- Muthén, L. K., & Muthén, B. O. (1998–2017). *Mplus user's guide* (8th ed.). Los Angeles, CA: Muthén & Muthén.
- Nagy, G., Trautwein, U., Baumert, J., Köller, O., & Garrett, J. (2006). Gender and course selection in upper secondary education: Effects of academic self-concept and intrinsic value. *Educational Research and Evaluation, 12*, 323–345. <https://doi.org/10.1080/13803610600765687>.
- National Center for O*NET Development O*NET OnLine. Retrieved March 21, 2019, from <https://www.onetonline.org/>.

- Nurmi, J.-E. (2004). Socialization and self-development: Channeling, selection, adjustment, and reflection. In R. M. Lerner, & L. Steinberg (Eds.). *Handbook of adolescent psychology* (pp. 85–124). Hoboken, NJ: Wiley.
- OECD (2013). *PISA 2012 Assessment and analytical framework: Mathematics, reading, science, problem solving and financial literacy*. OECD Publishing <https://doi.org/10.1787/9789264190511-en>.
- OECD (2016). Socio-economic status, student performance and students' attitudes towards science. *PISA 2015 results (volume I): Excellence and equity in education* Paris: OECD Publishing. <https://doi.org/10.1787/9789264266490-10-en>.
- Official Statistics of Finland. (n.d.). Social classifications. Helsinki: Advisory board of OSF. Retrieved from: https://www.stat.fi/meta/luokitukset/index_henkilo_en.html.
- OECD (2019). *PISA 2018 Results (Volume II): Where All Students Can Succeed*. Paris: OECD Publishing. <https://doi.org/10.1787/b5fd1b8f-en>.
- Parker, P., Nagy, G., Trautwein, U., & Lüdtke, O. (2014). Predicting career aspirations and university majors from academic ability and self-concept: A longitudinal application of the internal/external frame of reference model. In I. Schoon, & J. S. Eccles (Eds.). *Gender differences in aspirations and attainment: A life course perspective* (pp. 224–246). Cambridge: University Press.
- Pinxten, M., Marsh, H. W., De Fraine, B., Van Den Noortgate, W., & Van Damme, J. (2014). Enjoying mathematics or feeling competent in mathematics? Reciprocal effects on mathematics achievement and perceived math effort expenditure. *British Journal of Educational Psychology*, *84*, 152–174. <https://doi.org/10.1111/bjep.12028>.
- Räsänen, P., Linnanmäki, K., Korhonen, J., Kronberg, N., & Uppgård, A. (2013). *KTLT mathematical achievement test - Finnish-Swedish version*. [Online measurement] Niilo Mäki Institute. Retrieved from <http://www.neure.fi>.
- Reilly, D. (2012). Gender, culture, and sex-typed cognitive abilities. *PLoS One*, *7*. <https://doi.org/10.1371/journal.pone.0039904>.
- Rojewski, J. (2002). Preparing the workforce of tomorrow: A conceptual framework for career and technical education. *Journal of Vocational Education Research*, *27*, 7–35. <https://doi.org/10.5328/JVER27.1.7>.
- Salmela-Aro, K., Kiuru, N., Leskinen, E., & Nurmi, J.-E. (2009). School burnout inventory (SBI). *European Journal of Psychological Assessment*, *25*, 48–57. <https://doi.org/10.1027/1015-5759.25.1.48>.
- Salmela-Aro, K., Savolainen, H., & Holopainen, L. (2009). Depressive symptoms and school burnout during adolescence: Evidence from two cross-lagged longitudinal studies. *Journal of Youth and Adolescence*, *38*, 1316–1327. <https://doi.org/10.1007/s10964-008-9334-3>.
- Salmela-Aro, K., & Upadyaya, K. (2017). Co-development of educational aspirations and academic burnout from adolescence to adulthood in Finland. *Research in Human Development*, *14*, 106–121. <https://doi.org/10.1080/15427609.2017.1305809>.
- Savolainen, H., Ahonen, T., Aro, M., Tolvanen, A., & Holopainen, L. (2008). Reading comprehension, word reading and spelling as predictors of school achievement and choice of secondary education. *Learning and Instruction*, *18*, 201–210. <https://doi.org/10.1016/j.learninstruc.2007.09.017>.
- Schaufeli, W. B., Martínez, I. M., Pinto, A. M., Salanova, M., & Bakker, A. B. (2002). Burnout and engagement in university students: A cross-national study. *Journal of Cross-Cultural Psychology*, *33*, 464–481. <https://doi.org/10.1177/0022022102033005003>.
- Schoon, I., & Parsons, S. (2002). Teenage aspirations for future careers and occupational outcomes. *Journal of Vocational Behavior*, *60*, 262–288. <https://doi.org/10.1006/jvbe.2001.1867>.
- Shapka, J. D., Domene, J. F., & Keating, D. P. (2006). Trajectories of career aspirations through adolescence and young adulthood: Early math achievement as a critical filter. *Educational Research and Evaluation*, *12*, 347–358. <https://doi.org/10.1080/13803610600765752>.
- Tomasetto, C., Mirisola, A., Galdi, S., & Cadinu, M. (2015). Parents' math-gender stereotypes, children's self-perception of ability, and children's appraisal of parents' evaluations in 6-year-olds. *Contemporary Educational Psychology*, *42*, 186–198. <https://doi.org/10.1016/j.cedpsych.2015.06.007>.
- Trautwein, U., Marsh, H. W., Nagengast, B., Lüdtke, O., Nagy, G., & Jonkmann, K. (2012). Probing for the multiplicative term in modern expectancy-value theory: A latent interaction modeling study. *Journal of Educational Psychology*, *104*, 763–777. <https://doi.org/10.1037/a0027470>.
- Tuominen-Soini, H., Salmela-Aro, K., & Niemivirta, M. (2008). Achievement goal orientations and subjective well-being: A person-centred analysis. *Learning and Instruction*, *18*, 251–256. <https://doi.org/10.1016/j.learninstruc.2007.05.003>.
- Tuominen-Soini, H., Salmela-Aro, K., & Niemivirta, M. (2012). Achievement goal orientations and academic well-being across the transition to upper secondary education. *Learning and Individual Differences*, *22*, 290–305. <https://doi.org/10.1016/j.lindif.2012.01.002>.
- Viljaranta, J., Nurmi, J.-E., Aunola, K., & Salmela-Aro, K. (2009). The role of task values in adolescents' educational tracks: A person-oriented approach. *Journal of Research on Adolescence*, *19*, 786–798. <https://doi.org/10.1111/j.1532-7795.2009.00619.x>.
- Wang, M.-T., Chow, A., Hofkens, T., & Salmela-Aro, K. (2015). The trajectories of student emotional engagement and school burnout with academic and psychological development: Findings from Finnish adolescents. *Learning and Instruction*, *36*, 57–65. <https://doi.org/10.1016/j.learninstruc.2014.11.004>.
- Wang, J., & Wang, X. (2012). *Structural equation modeling: Applications using Mplus*. Beijing: Higher Education Press.
- Watt, H. M., Shapka, J. D., Morris, Z. A., Durik, A. M., Keating, D. P., & Eccles, J. S. (2012). Gendered motivational processes affecting high school mathematics participation, educational aspirations, and career plans: A comparison of samples from Australia, Canada, and the United States. *Developmental Psychology*, *48*, 1594–1611. <https://doi.org/10.1037/a0027838>.
- Widlund, A., Tuominen, H., & Korhonen, J. (2018). Academic well-being, mathematics performance, and educational aspirations in lower secondary education: Changes within a school year. *Frontiers in Psychology*, *9*, 297. <https://doi.org/10.3389/fpsyg.2018.00297>.
- Wigfield, A., & Eccles, J. S. (2002). The development of competence beliefs and values from childhood through adolescence. In A. Wigfield, & J. S. Eccles (Eds.). *Development of achievement motivation* (pp. 91–120). San Diego, CA: Academic Press.